

MAThUP

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Second version**

WP 3, T 3.6.3

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Abbreviations and Acronyms

Acronym	Description
API	Application Programming Interface
CKAN	Comprehensive Knowledge Archive Network
DCAT	Data Catalogue
DCIP	Data Catalogue Interoperability Protocol
DSPL	Google Dataset Publishing Language
EIP	European Innovation Partnership
ETL	extraction, transformation, and loading operations.
FME	Feature Manipulation Engine
GDPR	European General Data Protection Regulation
IDC	International Data Corporation
LANs	local area networks
NGSI	Next Generation Services Interface
OGC	Open Geospatial Consortium
API	Application Programming Interface
ODP	Open Data Portal
TLS	Transport Layer Security
REST	Representational State Transfer
UP	Urban Platform
WFS	Web Face Service
WAN	Wide Area Networks



1 Abstract

This deliverable aims to report on the current state of Urban Platform concepts and developments (Task 3.6). This task is in charge of developing a number of services to improve city operation, decision making services, and citizen engagement to ensure the interaction between the city of Dresden and its citizens.

When creating new services on top of the Urban Platform, it becomes fundamental to deal with the need of studying the adaptations and extensions regarding the Integration and Interoperability with regard to publishing open Data, open APIs and data integration from the actions to be deployed in the city interventions of Dresden demo site.

This deliverable describes the requirements of the future Urbane Platform in regards to existing and newly created data sets, way of data collection as well as open API concepts and use of standardized protocols and metadata exchanges. These requirements, also in regard to privacy issues, and the overall comprehensive approach of the Dresden UP leads to specifications also for the Urban Platform Adaptations (Services and Application) described in D3.21.

Moreover, it will be necessary to publish non-sensible and anonymized data for being queried and explored by citizens and developers willing to make use of it in order to create innovative services for the city. Therefore, it is worth noting that privacy and security aspects should be taken into account, paying special attention to the new European General Data Protection Regulation (GDPR) [1].

Definition of interoperability for all Lighthouse Cities was done in order to establish a most harmonised approach and matched test plan in the three demos. Definition of interoperability tests for Dresden Urban Platform that can assure the interoperability of its modules of the UP. Testing of new modules developed on top of the Urban Platform, ensuring interoperation by following the open API concepts of Valencia, Dresden and Antalya.

As far as the MAtchUP cities share common objectives, the deliverable of Valencia (D2.23), Dresden (D3.23) and Antalya (D4.23) are structured identically. This deliverable is due in M24 and a finalized version will be delivered in M36 (D3.24).



2 Introduction

2.1 Objectives

The objective of this deliverable is to report on the current state of concept and development of the urban platform integration and interoperability in Dresden demo site.

Within Dresden Demosite (WP3) the development of the Urban Platform (UP) will be in charge of developing a number of services (see also D3.21) to improve city operation, decision-making services, citizen engagement, and to ensure the interaction between the city of Dresden and its citizens. All these developments will follow the same principles: ensuring open / citizen data, interoperability through open API (open Application Programming Interface) developments and assessing the evaluation process by considering the requirements of the Dresden monitoring plan outlined in Task 5.1.

This Deliverable mainly addresses Task 3.6 Urban Platform developments (Open data, Open APIs, Integration, Security) with Subtask 3.6.3 Integration and Interoperability. The Definition of interoperability test plan for Dresden is established by a harmonised approach among the three demos. Testing of new modules developed under the top of the Dresden Urban Platform ensures that the UP interoperates within those from Valencia and Antalya by following the open API concept in the Urban Platforms of Valencia and Antalya too.

The objective of this deliverable is to report on the characteristics that the Urban Platform of Dresden is going to adopt in line with open data strategies, open APIs and data integration requirements. In the context of MAtchUP, the requirements of the Urban Platform must be specified, considering the Dresden demo site actions, interventions and the overall objectives of the project. These have to be carried out within the main chapters of MAtchUP: Mobility, Energy and ICT but also about the Non-Technical Actions facing economic and social aspects as well. Moreover, reference architectures for urban platforms and related European urban projects must also be taken into account. The definition of data models is important, since they are the frames to be followed for data exchange among modules. The fact of having a robust and well-defined data model will maximize the interoperability between the components of the system. Moreover, citywide metadata sets are made available in a catalogue.

Additionally, the interoperability performance must be assessed in order to confirm that the functionality of the new services is preserved. Moreover, security and privacy issues are addressed.



2.2 Contribution of partners

The following Table 1 depicts the main contributions from participant partners in the development of this deliverable.

Participant short name	Contributions
TUD	Content
DRE	Content and additional information
EASD / DWG / FhG	Comments on related issues

Table 1. Contribution of partners



3 Interoperability definition

In general, interoperability refers to the capability of two or more networks, systems, devices, applications, or components to exchange and readily use information securely, effectively, and with little or no inconvenience to the user. This common definition stated in the current literature. Next sections will focus on applying this definition to the context of Smart Cities, and more precisely, to the scope of MATchUP project.

Interoperability is the ability for systems to exchange data with other systems in a harmonized and homogeneous way by using open formats, standard formats, and protocols. Within the European Innovation Partnership (EIP-SCC) framework, the priority is “on ensuring the vertical interoperability” (development of reusable and interoperable services) instead of “prioritizing the horizontal interoperability” (in between platforms) [2]. Thus, to maximize the potential replicability and scalability of the developments on top of the Urban Platforms, vendor lock-in solutions must be avoided, as interoperability and scalability are hampered with these locked approaches.

3.1 Interoperability in the Smart City context

The Dresden Urban Platform uses various software components to store its data. To ease future data exchanges further developments of the Urban Platform will ensure that all systems premised on open data formats and APIs as wells as standards like OGC (WFS, WMS, etc.), CKAN¹, DCAT-AP/DCAT-AP.de² and the SensorThings-API.

Open Geospatial Consortium (OGC) standard provides an open and unified framework to interconnect IoT sensing devices, data, and applications over the Web. It is an open standard addressing the syntactic interoperability and semantic interoperability of the Internet of Things. Using open APIs and standards allows integrating multiple different data formats by extracting, transforming and loading data from a source into a standardized format, hence making it available to the public too.

The definition and development of interoperability standards at API level provides furthermore the opportunity to third parties working on high-level services with the UP's data. These are interoperable under multiple platforms. By this, new businesses, intellectual growth services are created and more knowledge may be shared digital and supported. (Please also see D3.21 Chapter 6 6 Open API Adaptation.)

¹ Comprehensive Knowledge Archive Network (CKAN) is a web-based open-source management system for the storage and distribution of open data. Being initially inspired by the package management capabilities of Debian Linux, CKAN has developed into a powerful data catalogue system that is mainly used by public institutions seeking to share their data with the general public. <http://daten.dresden.de/duva2ckan/files.html>

² The DCAT Application profile for data portals in Europe (DCAT-AP) is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing metadata of public sector data sets in Europe. It is the standard used by the European Data Portal as well. <https://www.dcat-ap.de/def/>



3.2 State of the art and related challenges

One of the challenges faced by the project is to process and visualize data from heterogeneous systems and environments, such as sensors or the owner platforms involved. All these systems must be integrated in a common platform and for this purpose, it becomes necessary to guarantee the interoperability of data. In the context of Smart Cities information is obtained from different elements of the city, such as street lighting or buses, which use different protocols to send information. FIWARE was supposed to be in charge for translating all the information gathered from different sources into a common language. The use of FIWARE would have allowed us to replicate and scale this platform in other cities without major adaptation efforts.

In order to eliminate some of the barriers encountered with FIWARE we have decided to employ the use of Feature Manipulation Engine (FME). In addition, the interaction between the Open Data Portal DUVA and FIWARE would have been problematic. A meaningful connection would have been the basis for the selection of CKAN. FME is a data integration platform with the best support for spatial data worldwide, which easily addresses the question of “where” and converts your data precisely for your needs. It can build own custom workflows that improve access to data and solve compatibility issues, without needing to code anything. With FME we can automatically process data in real-time by defining events that trigger data integration workflow by using automations. Therefore, a directory, email address or web service run the workflow(s) when an event occurs. By identifying specific triggers, actions and reactions, new data uploads or data requests can be made instantaneously without needing manual interaction by the author.

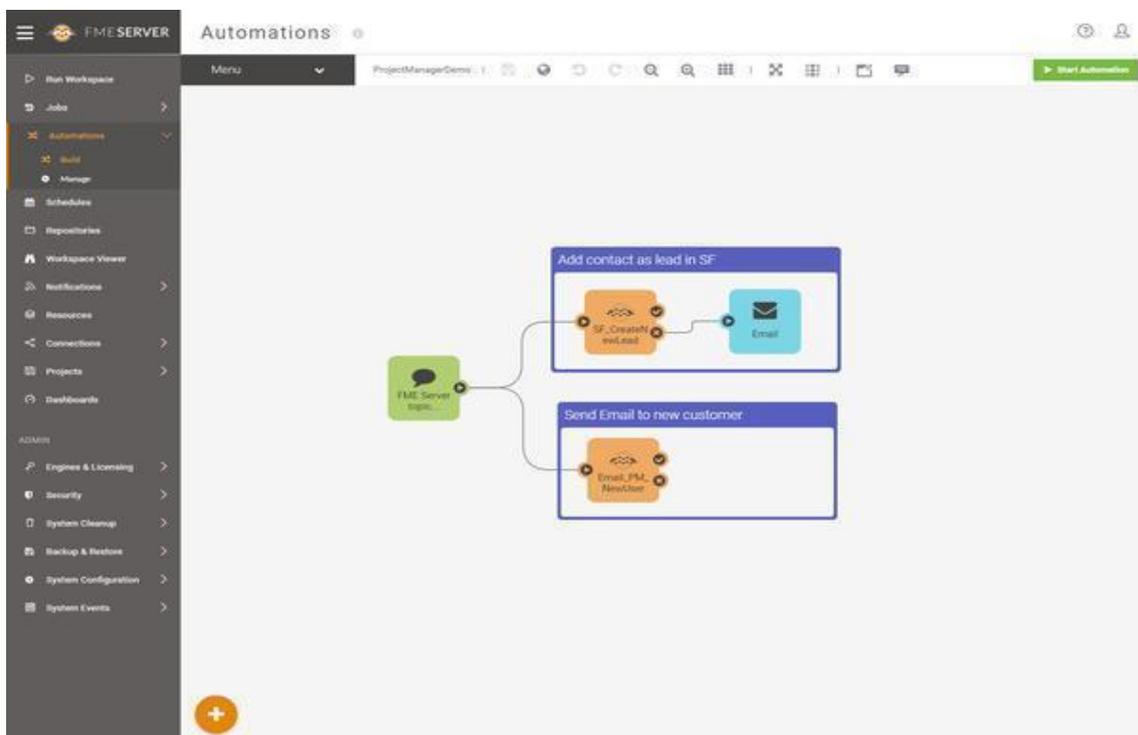


Figure 3.1: Event-Driven Actions can be easily defined with FME

The FME's REST-APIs allow interaction with a server or another node on a web network using the simplicity of the HTTP protocol. Representational State Transfer (REST) is a software architectural style that defines a set of constraints to be used for creating Web services. The REST-API concept is not a standard, but rather a set of guidelines that promote simple, easy-to-use web APIs. The FME Server REST-APIs provide methods to control a range of FME Server functionality, including:

- ✓ Sending, receiving and modifying notifications
- ✓ Running jobs and viewing job history
- ✓ Managing user accounts, roles, and policies
- ✓ Managing clean-up tasks
- ✓ Scheduling jobs
- ✓ Managing user settings and favourites
- ✓ Uploading and managing file resources
- ✓ Publishing workspaces and managing published parameters

3.3 Regulatory framework for interoperability

In order to eliminate the barriers that generated when integrating different heterogeneous systems and to create a common platform to guarantee interoperability, a regulatory framework is needed, so that it defines standards to be applied and a set of principles to be met.

3.3.1 National interoperability standards

DCAT-AP.de is the German derivation of the European standard DCAT Application profile. The DCAT Application profile for data portals in Europe (DCAT-AP) is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing metadata of public sector data sets in Europe. It is the standard used by the European Data Portal as well.

The standard design DCAT-AP in the specification DCAT-AP.de meets semantic regulations for the communication of municipal data portals, trade and state data portals as well as specialist portals, and governmental portals for GovData portal and from there to the EU portal. A specific transport protocol for metadata exchange was not defined yet. However, DCAT-AP including the German form DCAT-AP.de is compatible with various communication protocols. DCAT-AP.de is also able to communicate via archives with other protocol standards, as an example the reference implementation in the GovData portal (<https://www.govdata.de/>). Other non-normative components of the standard design are the following example implementations and validation artefacts: 1) JSON Schema and related sample data minimum and maximum, 2) RDF / XSD schema and associated RDF sample data minimum and maximum, 3) c. XML / XSD schema and related sample data minimum and maximum.

3.3.2 International interoperability standards

The IDABC - European Framework for Interoperability has published "European Interoperability Framework for Pan-European eGovernment Services" for administrations, business and citizens [3]. Furthermore, European Parliament and the Council



has published a guide for public administrations in September 2009 with a decision number 922/2009 including action plans for e-government on interoperability by aiming to inform policies of open data sharing, reusing and cooperation [4]. There are also some Open standards publicly available. These are standards that are global and regardless any individuals or free of legal or technical situations that limit their use.

So the following standard formats are used within the Dresden Urban Platform:

DCAT-AP: The DCAT Application Profile for data portals in Europe is a specification based on the Data Catalogue Vocabulary (DCAT) developed by W3C. This application profile is a specification for metadata records to meet the specific application needs of data portals in Europe while providing semantic interoperability with other applications on the basis of reuse of established controlled vocabularies (e.g. EuroVoc) and mappings to existing metadata vocabularies (e.g. Dublin Core, SDMX, INSPIRE metadata, etc.).

GeoDCAT-AP: Extension of DCAT-AP for describing geospatial datasets, dataset series and services. It provides an RDF syntax binding for the union of metadata elements defined in the core profile of ISO 19115:2003 [5] and those defined in the framework of the INSPIRE Directive [6]. Its basic use case is to make spatial datasets, data series and services searchable on general data portals, thereby making geospatial information better searchable across borders and sectors.

StatDCAT-AP: Another extension of DCAT-AP that provides specifications and tools that enhance interoperability between descriptions of statistical data sets within the statistical domain and between statistical data and open data portals.

CSW: Catalogue Service for the Web (CSW), sometimes seen as Catalogue Service - Web, is a standard for exposing a catalogue of geospatial records in XML on the Internet (over HTTP). The catalogue is made up of records that describe geospatial data (e.g. KML), geospatial services (e.g. WMS), and related resources.

REST (Representational State Transfer): Standard interface for web applications approached in 2000, which is generally used to develop APIs.

INSPIRE Metadata Schema INSPIRE is a Directive of the European Parliament and of the Council aiming to establish a “EU-wide spatial data infrastructure to give access to information that can be used to support EU environmental policies across different countries and public sectors” (INSPIRE) [6]. The actual scope of this information corresponds to 34 environmental themes, covering areas having cross-sector relevance, e.g. addresses, buildings, population distribution and demography. To maximize the interoperability of data infrastructures operated by EU members, INSPIRE proposes a framework using common specifications for metadata, data monitoring, sharing and reporting. INSPIRE consists of a set of implementing rules along with a listing of corresponding technical guidelines. For metadata schema, the INSPIRE implementing rules include guidelines for the description of data sets, which could be adopted by open data publishers.

CKAN is the most widely used open-data-portal-software today, and as such, especially regarding its respective metadata framework, it is a kind of de-facto standard. The CKAN metadata is exposed via RESTful API and data uploaders will



need to fill in the metadata with the API request. CKAN defines three top-level metadata concepts to describe a given data set:

- 1) package: title, notes, tags, revision_timestap, owner_org, maintainer, maintainer_email.
- 2) resource: description format, resource_type, webstore_url, size, group (name, title, type, state).
- 3) organisation: name, id, title ,description, state.

The package, resource and group can be roughly mapped to DCAT as dcat:Dataset, dcat:Distribution, dcat:Catalog and foaf:Agent.

Data Catalogue Interoperability Protocol (DCIP)³– DCAT is the most recent metadata standard that enables the sharing of metadata across different data catalogues. However, the actual implementation of DCAT is still needed to access the metadata and serialize it into different formats. In this context, the DCIP is a specification designed to facilitate interoperability between data catalogues published on the Web and is complementary to DCAT. It provides a protocol (REST API) to access the data defined in DCAT. One of DCIP's main targets is to develop a CKAN plugin to expose CKAN metadata as DCAT, but this work is still in progress.

Schema.org is a collection of schemata (in RDF/Microdata format) that webmasters can use to mark-up HTML pages in ways recognised by major search engines. Schema.org covers many domains and there are classes and properties defined as Data Catalogue and Dataset. In the context of an Urban Platform the vocabulary of schema.org can be used to discover the hosted data sets and data catalogues.

Google Dataset Publishing Language (DSPL)⁴ is a data and metadata format designed from the ground up to support powerful, interactive visualizations like those in the Google Public Data Explorer. It is a representation language for the data and metadata of data sets. Data sets described using this format can be visualised directly from Google Public Data Explorer.

The formats **GeoDCAT-AP** and **StatDCAT-AP** as well as DCIP are not in use, but can be considered in the following developments.

Schema.org and **Google Dataset Publishing Language** will probably never be used. The 2nd variant with Google would however result in an improvement of the search in the net.

³ Data Catalogue Interoperability Protocol (DCIP) DCAT is the most recent metadata standard that enables the sharing of metadata across different data catalogues. <http://spec.dataportals.org/>

⁴ DSPL is a data and metadata format designed from the ground up to support powerful, interactive visualizations like those in the Google Public Data Explorer. <https://developers.google.com/public-data/>



4 Smart City modules definition

4.1 Requirements for Urban Platform Integration and Interoperability

The Urban Platform is an intellectual and logical approach to connect existing and future IT systems of the state capital Dresden as well as data provided by the local MAtchUP project partners. The systems involved are not only aware of each other, and exchange data, moreover they use their logical and analytical abilities in interactive processes to prepare decision-making and atomize processes. The prerequisites for the implementation of this logical approach are the use of state-of-the-art technologies and infrastructures, standards and services (technical services) as well as data and applications (apps). The aim is to improve the use of available infrastructure data in Dresden and to develop new applications on this basis or to give third parties the opportunity to create new business models on the basis of data in the city. The cross-office use of data is also improved.

To this end, MAtchUP will implement a targeted selection of practical applications for the Urban Platform and establish standards for the future. With regard to these standards, there is not only a need from a technical point of view, but increasingly also for conceptual standards. An urban platform is not only about the technical networking of the systems, but primarily about content and knowledge-based networking on a technical level. Building up knowledge requires the passing on of information, which in turn requires a technically understandable exchange of data. To make these data interchangeable, analysable and interpretable, conceptual standards must be created as a necessary prerequisite for constantly increasing data collection. The quality and quantity of services available within the Urban Platform have a decisive influence on the digital intelligence quotient of a Smart City.

Zukunft Dresden 2025+, an integrated urban development concept pursues an even more integrated approach. The overarching objectives for the city as a whole were brought into line with each other and with the sub-regional planning. All business areas of the state capital Dresden were included in the development. An integrated working group activity and interdisciplinary conferences ensured the comparison of the conceptual statements beyond the respective area of responsibility. A stronger focus on implementation to ensure the achievement of objectives at the urban and suburban level during the planning period is one of the main concerns of the integrated urban development concept. For this reason, the implementation process was equipped with a monitoring and indicator system and the dynamic target system was extended by a link to the municipal budget. By continuously reviewing the objectives, the target system is adapted to the current framework conditions and remains up-to-date for controlling the implementation process. Developments and changes in tasks can thus be responded to quickly and flexibly. It formulates the procedures and projects necessary to achieve the goals and sets priorities. Zukunft Dresden 2025+ is designed for a period of more than 10 years and is designed from the outset to be verifiable and updatable.



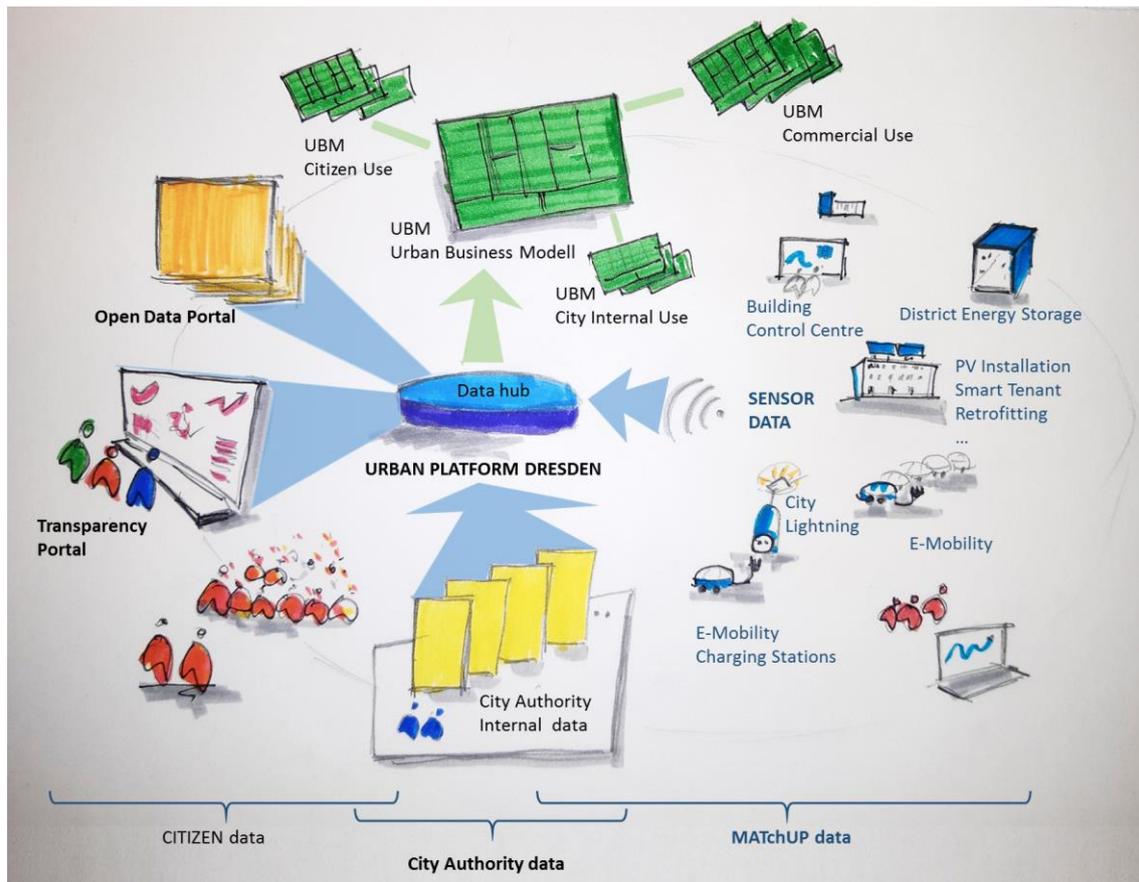


Figure 4.1: Dresden Urban Platform – content view

The concept and overall approach of Dresden Urban Platform is described more detailed in D3.21. The Municipality of Dresden, in line with its Digital Agenda, has developed a comprehensive ICT-Infrastructure in which many vertical services of the city are integrated by now. This Urban Platform of Dresden is in charge of gathering information from several municipal services in order to provide information for decision-making within the city of Dresden. Furthermore, the existing set of key indicators to support this decision processes needs to be elaborated. Another objective of the platform is to offer data to the citizens and municipal managers to support all the necessary information to ease their daily life.

The following vertical services are to be integrated and managed through this platform:

- ✓ sensor data (charging infrastructure)
- ✓ energy data (building control centre)
- ✓ urban data
- ✓ environmental data
- ✓ traffic data

The Smart City strategy of Dresden found its place in the guiding strategic planning documents approved by the city council and discussed with citizens in the course of the planning process. International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology

market. According to the IDC Smart City [7] encompassed processes that are based on a combination of information and communication technologies and further technologies to support urban organisation and development. The networked and intelligent infrastructure serves to improve competitiveness of the local economy, resource efficiency, strengthens the participation of citizens and helps to integrate social aspects. This allows citizens to be part of a wider network, allows for social integration, enables participation in the knowledge society and fosters thus a higher quality of urban life. The competences within the city in the fields of building, mobility, energy and government as well as security need to be enhanced.

A technical overview of Dresden Urban Platform can be seen in Figure 4.2. The core modules will be explained in the following sections.

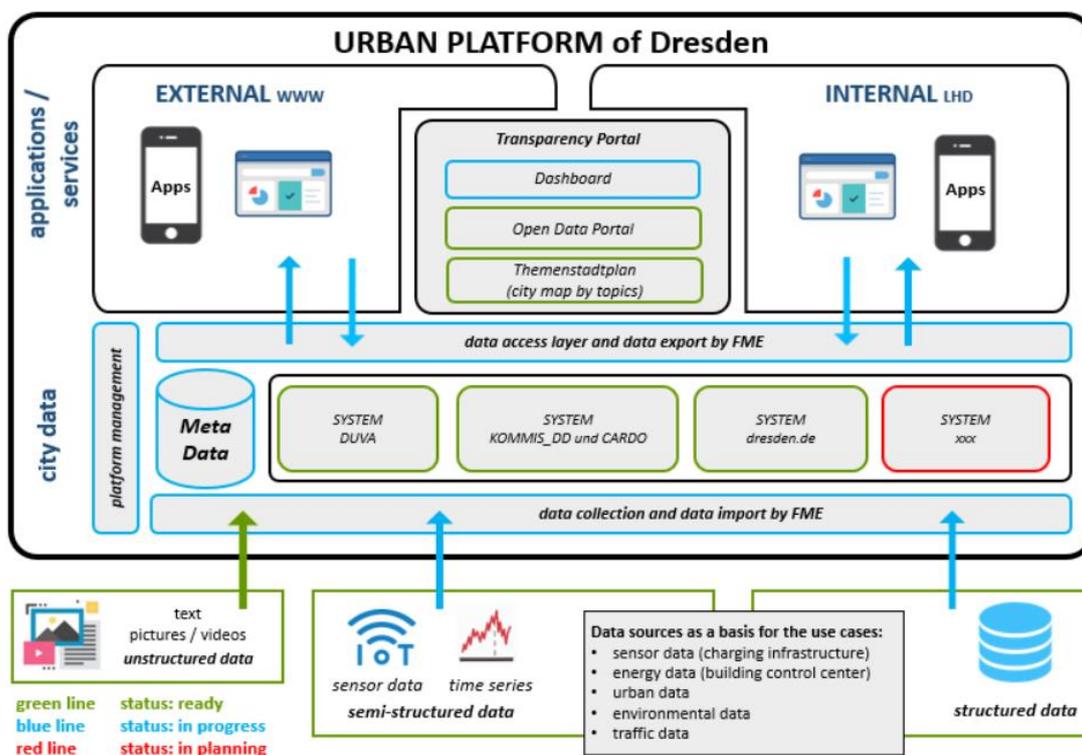


Figure 4.2: Technical Overview on Dresden Urban Platform

To enhance the interoperability capabilities and ensuring an appropriate scalability (extension of this Urban Platform), Dresden municipality has recently moved the physical (hardware) infrastructure to a new data center where the backbone has been extended and changed from 1 Gbit/s to 40 Gbit/s and various servers were connected directly to a new backbone. In addition to the higher data throughput, this also leads to lower latency times, increasing the efficiency of the systems mainly improving the real-time or near real-time connection to urban objects. Moreover, in October 2016, and very recently as well, a new step forward was made for the establishment of a common WLAN infrastructure for the LH Dresden that was discussed with municipal companies like DVB and DIG, supporting the digitalization of Dresden services.

Security and privacy is one of the main pillars of the Urban Platform, as sensitive data is managed. The security of the network infrastructure is ensured by various security

components, including for example, the multi-level firewall as well as the establishment of so-called demilitarized zone (DMZ), which ensures secure access by external users and, in particular, protects the internal network against unauthorized access. Another widely used secured access technology used is Virtual Private Network (VPN).

The following technologies are used for the standardization of the following services:

- Authentication: Microsoft Active Directory,
- APIs development: e.g. JAVA, IoT/M2M
- communications: ad-hoc web services,
- Geo-Information: ESRI Tools,
- eGovernment data: Online Shop, de mail, e Akte,
- KPIs calculations: ad-hoc solutions.

As a rough summary, around 1000 sensors are connected to the platform. The platform's main tool for the development of the Smart City strategy of the city of Dresden is developed based on the architecture shown in Figure 4.2 and operates in several back-end databases (DB2, Oracle, Microsoft SQL, MySQL, PostGreSQL). This platform can be considered as operational since 2004.

4.2 Core modules

4.2.1 Transparency Portal

The transparency portal currently consists of ODP and the Themenstadtplan: ODP is an interactive web application of the Dresden Municipal Statistics Office that uses the DUVA information portal that is an integrated part of the DUVA system. The portal provides a web interface with full-text search as well as a multi-faceted search. It can be used to create and publish tables, graphics, and maps. In addition, it allows creating customized evaluations and links to documents. The metadata is organized according to aspects such as space, time or subject area. All information resources of ODP can be made publicly available via a Comprehensive Knowledge Archive Network (CKAN) interface. CKAN is a web-based open-source management system for the storage and distribution of open data. Being initially inspired by the package management capabilities of Debian Linux, CKAN has developed into a powerful data catalogue system that is mainly used by public institutions seeking to share their data with the general public.

The Themenstadtplan [8] (see 4.2.4) is a map-centric web application that allows the visualization of geo references data in a user-friendly manner. An already very comprehensive list of some hundred topics (e.g. environmental information, parking information, cycle routes, information on schools or kindergartens) is available by now. This web portal is equipped with an API usable with CKAN GeoMISHarvester for instance. Furthermore, links to the MapControl are easy to be obtained and integrated to the corresponding CKAN data record. More general Dresden metadata will become a client of DUVA in the close future.

The transparency portal will be extended by an Open Data Portal using CKAN that should act as city wide data catalogue. It is planned to be used e.g. for capturing sensor data as well as to aggregate time series after specific periods. The output



modules of the Dresden Urban Platform can be distinguished into three types: value-added external services, the transparency portal and internal services and platforms used by the municipal administration. External services requirements to deliver new digital services that will address societal needs in a positive manner that relates to political narratives will provide all city data stakeholders ready access and delivery of data that unpins the decision making process.

4.2.2 Dashboard

The city's data provide insights into the situation on various aspects of the city administration, ranging from environmental and energy data to information on mobility. Real-time information that reflects the current situation in the city is particularly exciting to explore. The aim of the dashboard is to link and visualize real-time data on various urban topics with other (static and historical) information. The basics shall be created to present diverse information for different purposes.



Figure 4.3: Design of dashboard-widgets as a draft

To this end, the provision of information is possible by means of a tool to be created, a modular system is planned. Ideally it is a system with a broad developer community, preferably Open Source. The code for the system is to be further maintained by the city administration after completion, independently. In addition, existing content can be adapted and new content integrated. The dashboards should consist of tiles for individual topic blocks (see proposal for design - use of different widgets). These tiles are to be used beyond the composition for prefabricated Dashboards also for the

integration into the content sides of the urban Website www.dresden.de. The information should be accessible via the Internet (e.g. via [infobox.Dresden.de](mailto:infobox@Dresden.de)).

Based on the examples of other cities, the dashboard should be recognizable as a product of the city of Dresden. The colour specifications and logos are to be used accordingly. These are recorded in the style guide. The style guide serves as an orientation for the development beyond the named specifications. In addition, the pictograms and specifications for diagrams described in the appearance of the city of Dresden should be used as often as possible. The design and programming must be flexible so that the dashboards can be used on different devices.

4.2.3 Open Data Portal

The new Open Data Portal from the City of Dresden was implemented on the basis of the DUVA information management system (described in D3.21), it went live on 25.06.2019 and has been available online since that day. In the context of the implementation of the E-Government Law, the aim is to make neutralised administrative data freely accessible, free of charge and machine-readable for everyone. For the provision of this data, an automated and standardized publication on a platform opendata.dresden.de on the Internet will be used.

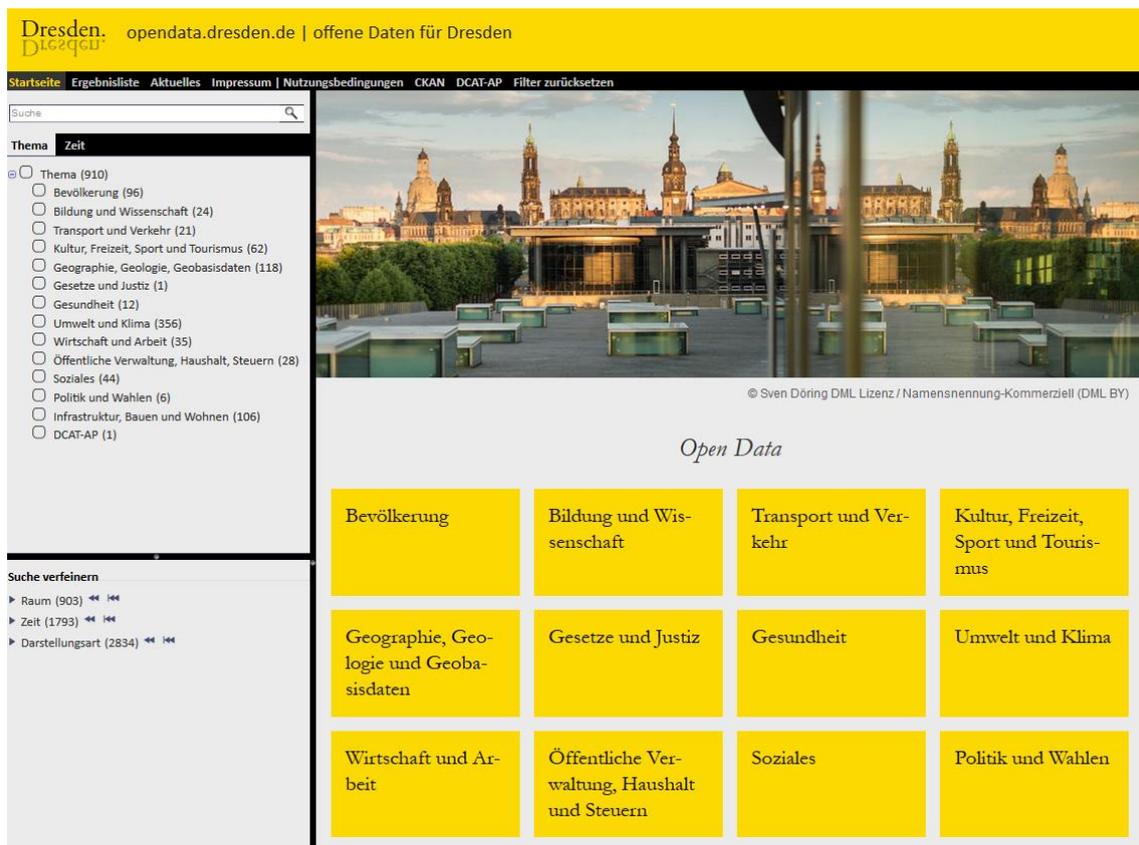


Figure 4.4: Open-Data-Portal City of Dresden

The Open Data Portal includes the realization, the integration into the Dresden dresden.de website, the automated publication, the examination of the need for protection as well as the examination and creation of legally compliant information on

the portal such as the imprint and disclaimers. Various offices were involved in the project. More than 300 data sets were made available when the Open Data Portal was published. Additional data sources will be successively integrated. The implementation of an Open Data Camp in November 2019 is in preparation. The Open Data Crunch aims at the use and exploitation of the published data of the Open Data Platform. In order to expand the existing network around the topic "Open Data" the city of Dresden cooperates with the Free State of Saxony in order to use the resulting synergies.

4.2.4 Themenstadtplan (Theme City Map)

The theme city map [8] is the external geodata portal of the City of Dresden on the Internet. In the Theme City Map about 300 topics of infrastructure and administration are published free of charge. There is a large selection of base and background maps - from aerial photographs to historical maps. The thematic city map serves to inform citizens, tourists, associations and companies and enables interactive participation in administrative processes.

This web portal is equipped with an API, which can be used for example with the CKAN GeoMISHarvester. Further links to the MapControl can be integrated into the corresponding CKAN data record.

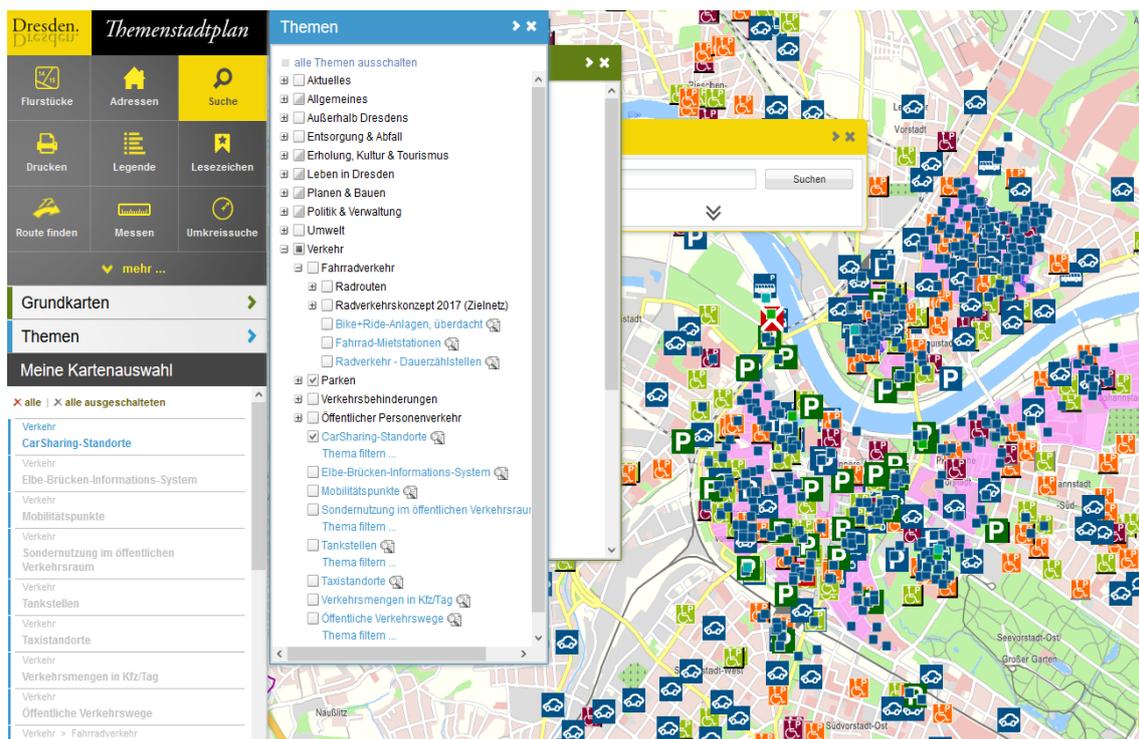


Figure 4.5: Themenstadtplan (theme city map)

4.2.5 Apps

4.2.5.1 Citizen Service App Services

The Citizen Service App Dresden (Bürger App)⁵ is an extended online service offer of the City of Dresden. It includes a garbage-detector for reporting pollution and other city related issues in Dresden. Issues like the following ones are addressed with this app:

1. e-petition system to create online petitions and online signing;
2. a “toilet finder” (for finding the nearest public sanitary facility including accessibility information);
3. a Dresden city map for orientation within the city;
4. a weather report for Dresden; an online appointment system for citizen's offices to book appointments via the smartphone; or
5. the “street art app” for indicating performances in the city.
6. A new parking service app has also been deployed which allows users of public parking to conveniently make all parking arrangements and pay online via the app.

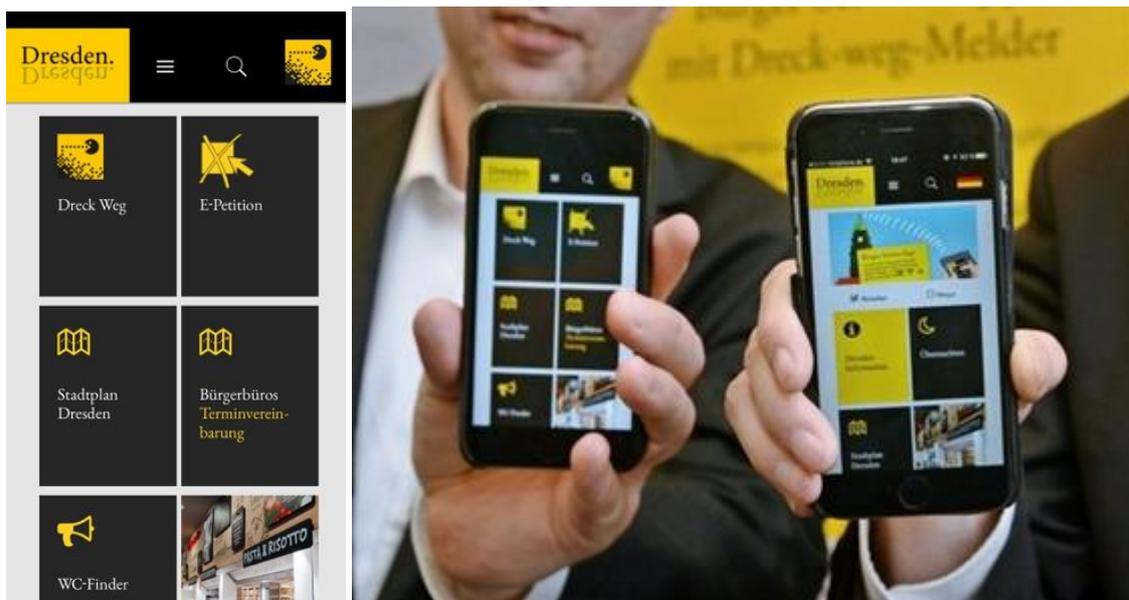


Figure 4.6: Citizen Service App Services

Complementary, the Dresden App addresses the requirements of tours offering bookable overnight stays and city tours, giving information about the main attractions and museums, insider tips from the areas of gastronomy, shopping and leisure.

⁵ Citizens Service App Dresden is an advanced online service of the City of Dresden. Functions as the dirt-away-detector and the E-Petition offer the opportunity to actively participate as citizens in the life of the city. <http://daten.dresden.de/de/tourismus/information/dresden-mobil.php>

4.2.5.2 DVB Mobility App

There is an existing public transport app (DVB Mobil), developed by FHG for irregular users who want to compare alternative offers for a particular requirement. An extension concept for this App or a standalone version will be created in the MATCHUP project and will be targeting regular users (commuters). The App will use the mobility notification service (Action 27) in order to check if daily commutes (either via public or private transport) are affected and will notify the user (only) in these cases by push notifications and recommends an alternative route or transport mode. It will then propose alternative transport routes or modes of transport to make a better use of the traffic network from a global management perspective.

The planned Mobility Platform in Dresden will offer many services and usability benefits to the user.

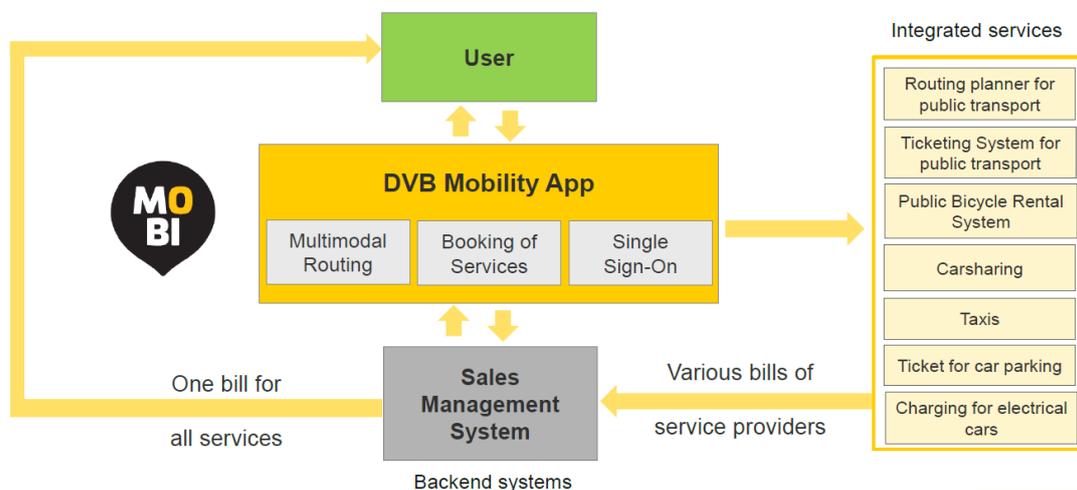


Figure 4.7: DVB Mobility Platform

4.3 Input and Output modules

Urban data can include data from public, industrial, scientific or private sources from increasingly heterogeneous sources. The spectrum of data sources ranges from sensors, e.g. generated by electric vehicles and bikes, smart lampposts and energy efficient buildings, to geo spatial data, statistical data and many more. The urban platform has to cope with this variety by providing powerful data ingestion method. For this need, ETL processes are required to perform the extraction, loading and transformation operations. The city of Dresden will use FME that provides interfaces to all common data formats (CSV, Excel, XML, ...) to communication standards (REST, XML-RPC, SOAP Web Service, ...), to file systems (FTP, Linux, NTFS, ...), middleware (IBM WebSphere MQ, Microsoft Azure Service Bus, OAQ, SAP JMS, ...) and to nearly all database systems. Later we also ingest real-time data using this communication standard interface.

5 Security aspects

Besides the technical issues on architecture, interoperability, and approachability cornering open data of the Urban Platform, the questioned challenge privacy and security is an indispensable task and plays an important role. Dealing with privacy and security aspects will remain an ongoing issue during the entire work with the Urban Platform. New data-sets will be generated, collected, and processed on the platform; new types of data e.g. sensor data are to be included into the platform. This approach of including new data-sets and new types of data is inevitable in a world where technology is continually evolving and further develops at a fast speed. Dresden Urban Platform already considers the importance of privacy and security aspects in its IT architecture. This is going to be continued in the further development work.

The regulation 2016/679 of the European Union published on April 27, 2016 and of application on the 25th of May 2018 (two years for organizations to adapt to the regulation). With the GDPR [1], also Dresden establishes the rules regarding the protection of natural persons with regard to the processing of personal data and the rules relating to the free movement of these data. Personal data is any information about an identified or identifiable natural person, i.e. whose identity can be determined, directly or indirectly, by means of a name, personal identification number, location data, etc.

Regarding security issues, all web components are using the https protocol with TLS (Transport Layer Security) for encryption and OAuth for authentication and authorization. For data-access and data-exchange specific policies need to be redefined. Relating to the collection of data, the potential for privacy issues certainly occurs when personal or sensitive data might be collected or given to third parties. When data-sets are combined and persons possibly can be identified, attention and awareness while developing UP and its application is needed. That is why Dresden's Commissioner for data protection is checking the core components of the Urban Platform. Some of the data from the core component contain personal data but most of the data is free from privacy issues. For the other data in the Urban Platform, the data controller will remain responsible for the content. Through a declaration the data controller has to confirm that the data has no privacy issues, that the collection of personal data is done on a legal basis and how to disclose the data. With this declaration, the provider of the data is responsible for dealing with privacy issues before the data is going to be a part of the Urban Platform. Finally, the Urban Platform makes data sets available via spatial data services which themselves are free from privacy issues.

However, everyone with access to these services can include and present the data in their own application. It is likely that other data sets and services are to be included into that third party application and are combined, overlaid and analysed together with the data from the Urban Platform. Checking privacy issues for this kind of third party applications is beyond the scope of the Urban Platform development. In terms of privacy, the Urban Platform of Dresden will follow set GDPR, of the EU. Nevertheless, this implies that for all data provided as open data, the German privacy law is in place.



All service providers towards the Urban Platform need to fulfil it prior to data provisioning these requirements.

The Association for Computing Machinery's Recommendation on Open Government (February 2009) stated, "Government bodies publishing data online should always seek to publish using data formats that do not include executable content." Executable content within documents poses a security risk to users of the data because the executable content may be malware (viruses, worms, etc.). The Urban Platform of Dresden will follow this guideline by avoiding to publish data as Microsoft Office documents including macros, i.e. files that end with: .docm, .xlsm. Data published as PDF will be checked whether they contain executable content in the form of Javascript.



6 Interoperability tests for interventions

The objective of Interoperability tests for interventions is to setup a strong evaluation framework (see also WP5) to be deployed in the three lighthouse cities with the aim to assess the effectiveness of the proposed intervention, deployed in the associated individual actions. This framework will address this performance not only from a purely technical perspective, but considering an economic and social assessment as well. CITYKEYS and SCIS initiatives will be the main references for the identification of KPIs and procedures. It will support the definition of the monitoring programs within MAtchUP mainly focusing to the selection of data acquisition and data sets.

After the evaluation framework has been established, the baseline for indicators will be defined in each Lighthouse city. The evaluation framework consists of core indicators, which are the same for similar actions by using for example, same calculation formulas and ideally same data collection interval, and complementary indicators, which are necessary for evaluating a specific action, but cannot be applied more widely in MAtchUP. Through Urban Platforms, the data acquisition and calculation of indicators will be made as automated as possible.

However, based on the previous experiences, many of the indicators will be qualitative or semi-qualitative in their nature, and measuring them will require manual data inputs. In many cases, the expected data source is the project manager or already existing project documentation. In addition, simulations are needed in relation to actions, where real data is not yet available. The framework ensures the comparability of similar actions in different cities by defining the same calculation formulas, measuring units, data collection intervals etc. The actual monitoring period in MAtchUP will last at least two years after the implementation of the actions. During this period, the interoperability in data collection will be followed every six months in able to supervise the process and analyse the data.

The definition of an open specifications framework, ensuring data reusability and interoperability through an open data and open APIs concept will complement the ICT Urban Platform developments, assessing the openness of all data generated by MAtchUP. UPV, TUD and SAM and will define the integration of these plans within the open specifications concept of the three urban platforms. MAtchUP will feed the SCIS and CITYKEYS databases, sharing all the calculated KPIs from the information gathered.

So far, the indicator lists are in preparation and related to the actions of Mobility, Energy, ICT, Social and Non-Technical Actions and interventions on Dresden Demo site. Coordinated by VTT in WP5 the Integrated Lists were published in D5.1 Technical, D5.2 Economical and D5.3 Social. In line with these outcomes the next version of D3.21 and D3.23 will derive a comprehensive interoperability tests plan for Dresden demo site aligned with the UP developments of Valencia and Antalya. As a first step of further developing the interoperability test plan for the different actions and interventions a proof of concept will be carried out before data testing and monitoring will take place.

The interoperability tests will allow for validation of the process or flow that information follows in relation to the Urban Platform in each of the project actions or interventions.



These tests have been shaped in different use cases, depending on the treatment carried out on the information. UPV, TUD and SAM will define the integration of these plans within the open specifications concept of the three urban platforms. MAtchUP will feed the SCIS and CITYKEYS databases, sharing all the calculated KPIs from the information gathered. More detailed definitions will be delivered with the final version of this in M36.



7 Action plan

The actions of Dresden Demo site are described in their detailed status in D3.14. Each Dresden action describes in there how the plans for the several interactions look like for the up-coming period and the next version of the deliverables. In regards of the integration and interoperability of the further developed Urban Platform, the several actions and Interventions of Dresden Demo site need to be interlinked not only within an intellectual concept, moreover, the technical developments are to ensure the Data Exchange and Open API concept described within this deliverable. Therefore, also the interdependencies of the Dresden interventions need to be further investigated and developed according to the integration strategy plans described.

To allow for the development of interoperability, thematic fields have to be identified between the lighthouses VAL, DRE and ANT where it is feasible to foster interoperability. This is an ongoing process. One aspect will be the overarching indicators for similar actions between the lighthouses from WP5 and partly WP1. Currently all existing use case and potential newly created cases are collected in an excel database mainly describing concept, content, in- and out-going data as well as different benefits and stakeholder groups. In parallel to the technical further development this use cases are to be described and evaluated in line with the list of indicators developed in WP1 and WP5.

Another specific one could come from the field of electro mobility. This will be an aspect developed in all lighthouse cities. A first approach for Interoperability could be to allow for an optimal use in charging infrastructure. Further fields will have to be continuously incorporated. We attach below information from 3 action cards that are directly connected to this deliverable: Open Data Gateway, Open Application Programming Interface and Internet of Things.

Action 60: New open data gateway

Year 1				Year 2				Year 3	Year 4	Year 5
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8			
(1)	(1)	(1)	(1)							
			(2)	(2)	(2)					
					(3)	(3)	(3)	(3)		
						(4)	(4)	(4)		
								(5)	(5)	(5)
			M12				M24	M36	M48	M60



Table 2. . Action 60 - Gantt chart - New open data gateway

Legend

- (1) Design phase
- (2) Selection of systems
- (3) Software development and implementation
- (4) Commissioning
- (5) Monitoring

The following progress was done until M24:

- Development of tech Analysis of existing processes and systems in the city of Dresden technical and business concepts
- Development of prototypes (rudiments)
- Development of architectural proposal for future development
- Use-case-workshops with all partners

Next Milestones: until 09/2020 [M36]

- Implementation of the central data exchange platform (urban platform)
- Conversion of the defined use cases
- Development of prototypes (rudiments)

Action 61 - New open API developments

Year 1				Year 2				Year 3	Year 4	Year 5
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8			
			(1)	(1)	(1)	(1)	(1)			
							(2)			
							(3)	(3)	(3)	
								(4)		
									(5)	(5)
							M1	M2		M3

Table 3. . Action 61 - Gantt chart - New API developments

Legend

- (1) Design phase
- (2) Selection of systems
- (3) Software development and implementation
- (4) Commissioning
- (5) Monitoring

The following progress was done until M24:

- analysis of existing processes and systems in the city of Dresden
- development of technical and business concepts



- development of prototypes (rudiments)
- interface analysis
- development of architectural proposal for future development
- use-case-workshops with all partners

Next Milestones: until 09/2020 [M36]

- interface programming
- conversion of the defined use cases

Action 63 - IoT Adapters

Year 1				Year 2				Year 3	Year 4	Year 5
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8			
(1)	(1)	(1)	(1)							
			(2)	(2)	(2)					
					(3)	(3)	(3)	(3)		
						(4)	(4)	(4)		
								(5)	(5)	(5)
			M12			M24	M36	M48	M60	

Table 4. . Action 63 - Gantt chart - IoT Adapters

Legend

- (1) Design phase
- (2) Selection of systems
- (3) Software development and implementation
- (4) Commissioning
- (5) Monitoring

The following progress was done until M24:

- Analysis of existing interfaces in the city of Dresden
- Development of technical and business concepts for IoT devices and sensors
- Use-case-workshops with all partners

Next Milestones: until 09/2020 [M36]

- implementation concept rely on the SensorThings API specification
- programming of interfaces for IoT devices and sensors
- conversion of the defined use cases



8 Conclusion

In D3.23, the current state of work, approach and development of the Urban Platform Integration and Interoperability in the city of Dresden has briefly described. All necessary requirements and specifications of the urban platform were characterized. By identifying existing and additionally needed components especially regarding exchange formats, smart city modules and open APIs the enhancement of new services in line with GDPR and security issues according to the MAtchUP interventions for improving the overall city management was fostered.

The overall concept as well as the Urban Platform IT architecture of Dresden has been shown. The currently used main Code module were described with more relevant details. Moreover, first improvement in order to model data, and to align security and privacy issues required in the urban platform were shown.

During the last period a lot of effort were spend in the further developments of the module and into the testing of the aimed interoperability of the MAtchUP interventions. The action plan was briefly described and will be more deeply explained in the final version of D3.23 in M36 (D3.24). For the next period the investigation on how to integrate data and knowledge from the Non-Technical Action into the UP and its specific requirements will be focused in order to address social and economic values and benefits bedside the pure technical ones.



9 References

- [1] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (GDPR – General Data Protection Regulation): <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679>, accessed at 01.09.2019.
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