MIMs Plus: Living-in.EU Technical Specifications

1. Background

This document contains the technical specifications of the Living-in.EU (LI.EU) upscaling declaration[1] initiative, and is based on existing minimal interoperability mechanisms (MIMs) plus some additional fundamental building blocks – hence the name: MIMs Plus. It is one of three deliverables from the LI.EU Technical sub-group, the others being a *concept paper*[2], describing the scope and time plan for the work, and an *operational guide*, with practical guidance on how the technical specifications can be used in practice.

Overall, the LI.EU declaration has six guiding principles, of which number five and six are especially relevant from a technical perspective:

1. A citizen-centric approach;
2. A city-led approach at EU level;
3. The city as a citizen-driven and open innovation ecosystem;
4. Ethical and socially responsible access, use, sharing and management of data;
5. Technologies as key enablers;
6. Interoperable digital platforms based on open standards and technical specifications, Application Programming Interfaces (APIs) and shared data models.

In addition to the principles above, there are five commitments made by the LI.EU signatories[3] and supporting parties[4]: Legal, Financing, Skills, Monitoring & Measuring, and Technical. The technical commitment has the following aims:

1. Use common standards and technical specifications;
2. Make key enablers (including data, infrastructure and services) available to all;
3. Establish a common market.

The first aim is covered by this MIMs Plus specification document, whereas the second and third aims are of a more operational nature, which are addressed in the Operational Guide.

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[1] https://www.living-in.eu/declaration
[2] https://www.living-in.eu/tech/concept-paper
[3] https://www.living-in.eu/we-signed
[4] https://www.living-in.eu/we-support

2. Introduction, Content & Reading Guide

This document refers to a consensus between a global group of cities, towns, and rural areas, and a variety of European initiatives to achieve minimal interoperability of solutions, services, and data at programme, project, and city level, under the moniker MIMs Plus. MIMs Plus ensures scaleability, shareability, and sustainability of outcomes, and protects governments, the public, and other stakeholder groups against vendor lock-in and undue influence.

MIMs Plus consists of two parts: 1. Minimal Interoperability Mechanisms (MIMs) and 2. relevant flanking European standardisation initiatives (Plus).

1. **MIMs (mims.oasc.io)** support institutional capacity development for connected places and work around three key layers:
    - **Interaction**: knowledge and context information exchange, rules of access and use for data and services, and management of location data
    - **Integrity**: protection of rights (personal data, privacy, dignity, equality,…), transparency (societal governance of all technology use and deployment), and security (systems and society)
    - **Impact:** driven by societal objectives with measurable outcomes towards those objectives, taking into account existing indicators, analytics, and resource management frameworks
2. **European standardisation initiatives** under the ‘Plus’ banner refer to e.g. EIF4SCC, ISA2, CEF, INSPIRE, EIP-SSC, ELIS, LORDI, and others. On top of minimal interoperability, local governments and other stakeholders can scope broader standards into their work where needed, with an open-ended baseline that can evolve as needs arise.

This document is based on and complements the input paper of the LI.EU declaration, states the current state of the art and gives recommendations for technical specifications. It aims to build capacity on top of standards, mechanisms, services, guidelines and tools that enable interoperability of data platforms for cities and communities, to mainstream the delivery of services with a strong positive local impact, while at the same time addressing overall European goals.

What are MIMs?
Minimal Interoperability Mechanisms (MIMs) are universal tools for achieving interoperability of data, systems, and services between cities and suppliers around the world. Because the mechanisms are based on an inclusive list of baselines and references, they take into account the different backgrounds of cities and communities and allow cities to achieve interoperability based on a minimal common ground.

Implementation can be different, as long as crucial interoperability points in any given technical architecture use the same interoperability mechanisms. The MIMs are vendor neutral and technology-agnostic, meaning that anybody can use them and integrate them in existing systems and offerings.

MIMs Plus version 4.0 DRAFT · 23 June 2021 ·
https://living-in.eu/groups/commitments/technical

The document is organized in five sections, starting with an introduction to an Architecture Framework Model and Data Information Models, followed by a section for each interoperability layer (Interaction, Integrity and Impact). Each layer consists of several MIMs which are further described based on:

- Goals: Identifies what the topic aims to achieve and what the main purpose is;
- Capabilities: Focuses on how the goals are achieved and what the necessary requirements are;
- Recommended specifications: Specs and standards proven to attain the goals;
- Means of verification: How conformance is tested and by whom it can be certified.

The governance of this specifications document is outlined in the concept paper. It is quite straight-forward: The MIMs Plus document is proposed by the LI.EU-Tech in evolving versions to be adopted by the LI.EU Steering Group. Each of the specific elements (like SAREF, OASC MIMs, INSPIRE, EIRA, OneM2M etc.) are governed by their respective governance fora.

Version history

Version	**Date**	**Main changes**
1.0	October 20, 2019	Initial draft consolidated report on technical specifications for the Digital Europe Programme and Living-in.EU (LI.EU)
2.0	December 6, 2019	Major update in advance of the pre-launch of LI.EU in Oulu, Finland, December 10, 2019
2.1	March 9, 2020	Update with input from European Commission services – DIGIT, GROW perspectives
2.2	April 29, 2020	Update before first meeting in the LI.EU Tech sub-group (May 12, 2020) – further fine-tuning of perspectives from the group
2.3	June 23, 2020	Update before third meeting in the LI.EU Tech sub-group (June 24, 2020) – focus on Personal Data Management and Fair AI, plus adjustments from the group
2.4	July 24, 2020	Adjustments of Personal Data Management and Fair AI
2.5	September 25, 2020	Update on the Personal data and Fair AI
3.0	December 18, 2020	Version release of Personal data and Fair AI
4.0 DRAFT	June 23, 2021	Update prior to the LI.EU Tech sub-group session on June 28, 2021 incorporating input from OASC Sweden and OASC following the OASC MIMs v1.0.1 update adopted by the OASC General Assembly 16 June, 2021

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3. Architecture Framework & Shared Data Models Layer

Architectural Goals

The goals of an architecture framework model for a digital ecosystem for cities and communities is to ensure that the capabilities of such platforms consider functional and non-functional requirements to implement the minimal interoperability that cities and communities need to deliver a prosperous, sustainable and inclusive future for their citizens.

The fundamental perspective is that of technical capabilities for minimal data interoperability. This focus backgrounds many implementation aspects, e.g. related to specific software and hardware stacks, and it allows great flexibility when it comes to adapting concrete deployment and integration to a local context. It is also based on a realisation from current experiences that establishing data spaces on a minimal but enough common ground can be a catalyst to deliver mainstream trusted services for cities and communities in a connected world.

The requirements for such data platforms should lead to specifications that ensure that the platforms are reliable, durable, future proof and performant so that the city can build on the platforms and foster further innovations and evolution. These specifications also ensure that the platforms can extend to a ‘system of systems’ with all relevant digital means of a community, scale to the needs of the cities and communities and guarantee privacy and security by design, making the platforms trustworthy.

Open source development and involvement of communities are powerful methods in order to guarantee transparency and consequently trust in the platforms for public operators. This particular aspect will be particularly relevant when injecting algorithms based on AI mechanisms into the platforms.

The implementation of minimal interoperability provides a common technical ground that cities and communities need to enable choice, flexibility, value for money and independence avoiding vendor lock-in. The platforms should support formal, de-facto and emerging standards, making sure they are future-proof and stable.

The trustworthiness and the interoperability of the platforms addresses the triple baseline of social, environmental and economic benefits, and supports strategic aims such as the United Nations sustainable development goals.

The platform architectures proposed in the recommended specifications and frameworks are validated in large scale pilots by a large variety of companies in close and direct partnerships with the cities and communities as well as networks of cities.

The group has recognised the Minimal Interoperability Mechanisms adopted by the Open & Agile Smart Cities Council of Cities[5] as a relevant way to organise the architectural framework and to strike a balance of precision in the technical specifications, neither over- nor under-specifying. The current document covers MIMs 1-10 in line with the new MIMs governance adopted during the General Assembly on 16 June 2021. Complementary sources of potential interoperability requirements are the European Interoperability Framework[6] and the European Interoperability Reference Architecture[7].

OASC MIMs Updated June 2020

MIM	Subject	Name	Status
MIM1	Context	OASC MIM1: Context Information Management	Governance
MIM2	Data Models	OASC MIM2: Shared Data Models	Governance
MIM3	Contracts	OASC MIM3: Ecosystem Transactions Management	Capability
MIM4	Trust	OASC MIM4:Personal Data Management	Capability
MIM5	Transparency	OASC MIM5: Fair Artificial Intelligence	Capability
MIM6	Security	OASC MIM6: Security management	Work item
MIM7	Places	OASC MIM7: Geospatial information management	Work item
MIM8	Indicators	OASC MIM8: Ecosystem indicator management	Work item
MIM9	Analytics	OASC MIM9: Data Analytics Management	Work item
MIM10	Resources	OASC MIM10: Resource Impact Assessment	Work item

[5] https://oascities.org/wp-content/uploads/2019/06/OASC-MIMs.pdf
[6] https://ec.europa.eu/isa2/sites/isa/files/eif_brochure_final.pdf
[7] https://joinup.ec.europa.eu/sites/default/files/distribution/access_url/2019-03/76cb237b-0de8-464c-84ca-1327945eac3e/EIRA_v3_0_0_Overview.pdf

Architectural Capabilities

The framework provides a description and guidelines of a common architecture/framework, including a layered overview positioning of all the components and interfaces, as well as the associated requirements and specifications. They include a description of reference implementations, including conformance testing and/or feedback from market use validation.

To go more into detail, we consider the following topics as common architectural design principles:

- A layered and capability-based approach to follow a common architectural model in different cities/domains.
- Based on open international standards (where available): we do not want to reinvent the wheel ensuring stable and widely used technological approaches.
- Compliant with existing technical solutions (e.g. already present in the cities with many legacy systems) focusing on interoperable interfaces rather than component implementation.
- Modular and scalable solutions for small and big cities: e.g. support different deployment scenarios and performance requirements.
- Security and privacy by design.
- Availability of reference implementations to foster and simplify the adoption in the cities.
- The architecture modularity assures the possibility to implement any component with different/proprietary technologies.
- Based on global, standard-based open APIs to enable both southbound/northbound interoperability.
- Data harmonisation and global standard based semantic interoperability through the adoption of common, linked data models.

In an upcoming version, it would be helpful to establish a more elaborated and robust ontology.

A framework for such an architecture is shown below (Figure 1). In this document the following (orange) parts are further discussed:

- Data information models and Context information management: Context information management realizes the Northbound open APIs and the Southbound APIs as a high-level open API. The Data information models provide the harmonized models.
- Marketplace: discusses the different marketplace API and transaction management (commercial as well as non-commercial).
- Data harmonization makes sure that data models can be harmonized to shared data models and between different standards.

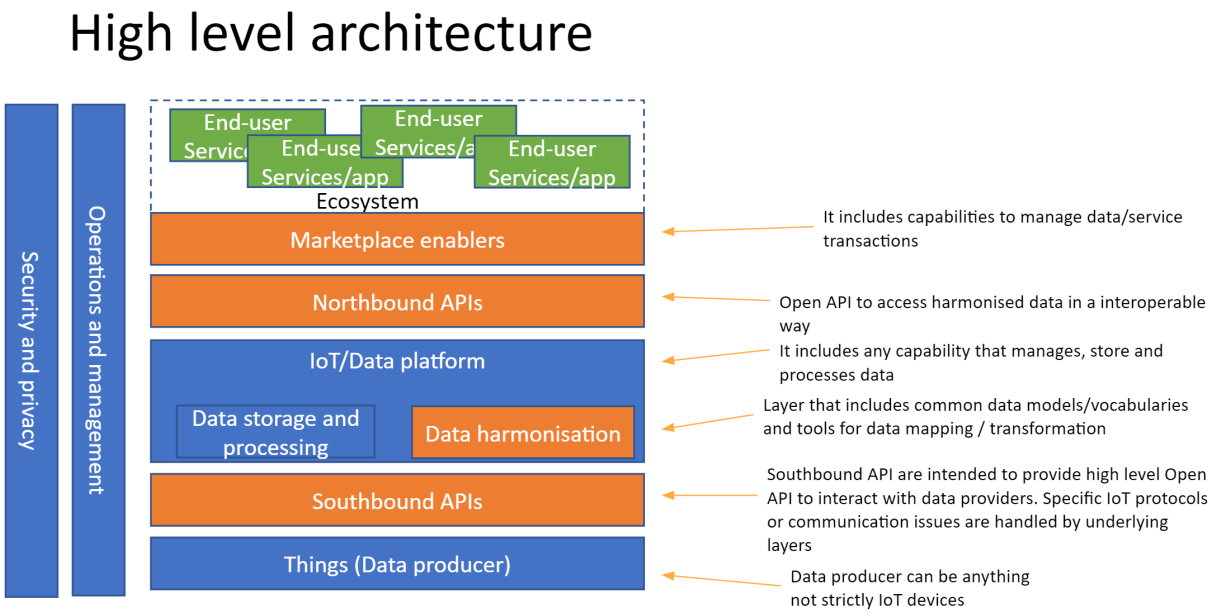

Figure 1. High-level architecture framework model.

Recommended specifications and frameworks

Below a list of specifications that are recommended:

- EIP SCC Reference architecture on Open Urban Platform (DIN SPEC 91357:2017-12) - Reference Architecture Model Open Urban Platform (OUP) https://www.beuth.de/en/technical-rule/din-spec-91357/281077528
- Guidelines for SynchroniCity Architecture https://synchronicity-iot.eu/wp-content/uploads/2018/05/synchronicity_d1_3_guidelines_for_synchronicity_architecture.pdf
- Synchronicity Reference Architecture for IoT Enabled Smart Cities, Update https://synchronicity-iot.eu/wp-content/uploads/2018/09/SynchroniCity_D2.10.pdf
- oneM2M Release 2 and release 3 set of specifications. oneM2M Release 2 has been formally approved as ITU-T recommendation under Y.4500 series. oneM2M is a partnership project, where EU is represented by ETSI, that specifies a common service layer for IoT. OneM2M is applicable to many verticals including Smart Cities. oneM2M specifications cover requirements, architecture, APIs, security, interworking and data models. Although not chartered to produce open source, there are several open source implementations supporting oneM2M, those include Eclipse OM2M and S. Korea OCEAN.
- The EIRA Library of Interoperability Specifications, ELIS is a repository of technical specifications based in open standards for the EIRA ABBs
- The CAMSS assessment Library is a repository of ICT open standards assessed using CAMSS
- SALAR Ten Proposed Principles for IoT-systems -- best practices for purchasing / achieving IoT-systems or IoT capabilities (Swedish): https://inera.atlassian.net/wiki/spaces/AR/overview

Means of verification

To guarantee the reliability and security of these platforms, certification tests by independent bodies may be applied to them in order to provide the necessary guarantees to public operators.

References

- ITU-T (06/2012) Series Y: Overview of the Internet of Things - Global information infrastructure, internet protocol aspects and next-generation networks-frameworks and functional architecture models
- ISO/IEC JTC1 Study Group on Smart Cities, “Resolutions 3, ISO/IEC JTC 1 N 11894, 201311-12,” 2012
- Systemic Standardisation Approach to Empower Smart Cities and Communities: “ESPRESSO Project”
- “The European Innovation Partnership on Smart Cities and Communities EIP-SCC,” [Online]. Available: https://smart-cities-marketplace.ec.europa.eu/
- ETSI GS CIM 009 V1.1.1 (2019-01) - Context Information Management (CIM); NGSI-LD API
- European Commission 2019 European Interoperability Reference Architecture, EIRA
- European Commission 2020 Core Public Service Vocabulary Application Profile
- European Commission 2020 Core Vocabularies
- European Commission 2017 Communication on The European Interoperability Framework- Implementation Strategy COM (2017) 134Annex 2
- European Commission API4Gov initiative

Shared Data Model Goals

Guidelines and catalogue of minimum common data models in different verticals to enable interoperability for applications and systems among different cities.

Harmonized representation formats and semantics that will be used by applications both to consume and to publish data.

Smart Data Models for interoperable and replicable smart solutions in multiple sectors, starting with smart cities but also for smart agrifood, smart utilities, smart industry, etc.

Capabilities

Data models serve as a language in which systems can talk to each other. Clear defined data models help cities in choosing and opening up data across solutions.

Data models should capture as much the complete context they are representing. This enables other applications to define what they need for their context and request the specific attributes they are interested in.

Harmonization across data models help in supporting different data models again to support the different applications out there. Clear definitions of the data models help in transforming this data models between the different standards

Specifications

- NGSI-LD compliant data models for aspects of the smart city have been defined by organisations and projects, including OASC, FIWARE, GSMA and the SynchroniCity project and there is an ongoing joint activity of TM Forum and FIWARE to specify more. This lead to an joint effort which resulted in the smart data models: Smart Data Models – An open initiative for agile data model standardization
- Existing data models and ontologies, e.g. the SAREF (Smart Applications REFerence ontology) standard by ETSI/oneM2M, can be mapped for use with NGSI-LD by identifying what are entities, properties and relationships, which can be managed and requested by the NGSI-LD API.
- oneM2M base ontology (that is compatible with SAREF). Additionally, oneM2M provides the means to instantiate ontologies as a means to provide semantic descriptions of the data exchanged (through the use of metadata)
- SAREF: Smart Appliances REFerence (SAREF) ontology specified by ETSI OneM2M committee with the extension of SAREF4Cities provides an ontology focused on smart cities
- Core vocabularies of ISA like Core Public Service Vocabulary Application Profile used as the basis for the Single Digital Gateway Regulation that touches local governments, Core Person, Core Organization etc

4. Interaction Layer

The Interaction Layer consists of three MIMS that lay out technical specifications for knowledge and context information exchange, rules of access and use for data and services, and management of location data (OASC MIMs 1, 3, 7).

4.1. Context Information Management

Goals

Data information models guarantee that we can disseminate and scale out a common data lingua franca based on shared data models. Context information management ensures holistic and integrated access to, use, sharing and management of data.

Capabilities

Context information contains comprehensive status information about real-world entities defined in a structured way with formal definitions and provides functionalities to enable access to different data sources and analyse context information, e.g. for detecting events.

The information that cities, regions and communities possess or gather is available and easily accessible to applications across different domains. To make the information usable the context information is key.

Applications are able to discover the information relevant to them. For example by specifying what is needed and retrieving or subscribing to this requested information. To share and re-use this information an agreement is in place on the concepts, this can be provided by data information models. Discovery and querying of information, both current and historical, is possible, also in a geospatial way. Applications can subscribe to changes of information, so that they are always aware of the current status.

The implementation across (and even within) the city, or any application ecosystem, can be very diverse and heterogeneous. An agreement on the interfaces is necessary to be able to access the information. This is enabled by the context management API and the data information models. The common data and data models are available in a catalogue and guidelines are available so that different verticals are integrated in a holistic/integrated city data lake to enable interoperability for applications and systems among different cities. The catalogue supports structural interoperability, behavioural interoperability (representation, data mappings) and governance interoperability.

Recommended specifications

- NGSI-LD, as specified by the ETSI Industry Specification Group on Context Information Management (ETSI ISG CIM), provides an API for managing and requesting context information and an underlying meta model based on entities - the

core information elements, often the digital counterparts of real-world object - and their properties and relationships to other entities.

- NGSI-LD compliant data models for aspects of the smart city have been defined by organizations and projects, including OASC, FIWARE, GSMA and the SynchroniCity project and there is an ongoing joint activity of TM Forum and FIWARE to specify more.
- Existing data models and ontologies, e.g. the SAREF (Smart Applications REFerence ontology) standard by ETSI/oneM2M, can be mapped for use with NGSI-LD by identifying what are entities, properties and relationships, which can be managed and requested by the NGSI-LD API.
- Even though the NGSI-LD specification has been published relatively recently, there are already three Open Source implementations (Scorpio, djane and Orion-LD). Orion-LD is the NGSI-LD version of the Connecting Europe Facility (CEF) building block Context Broker.
- oneM2M base ontology (that is compatible with SAREF). Additionally, oneM2M provides the means to instantiate ontologies to provide semantic descriptions of the data exchanged (through the use of metadata)
- SAREF: Smart Appliances REFerence (SAREF) ontology specified by ETSI OneM2M committee with the extension of SAREF4Cities provides an ontology focused on smart cities
- Core vocabularies of ISA like Core Public Service Vocabulary Application Profile used as the basis for the Single Digital Gateway Regulation that touches local governments, Core Person, Core Organization etc
- The following specification is in development: INSPIRE: will develop WFS3 by OGC

Verification

ETSI organized a Testing Task Force (TTF) to create a Testing toolkit to validate context brokers towards the NGSI-LD specification. The result was a set of clear defined test descriptions, test purposes and executable robot scripts. All this information can be found on the ETSI CIM Website https://www.etsi.org/comittee/cim.

References

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- European Commission 2020 Core Public Service Vocabulary Application Profile https://joinup.ec.europa.eu/solution/core-public-service-vocabulary-application-profile
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- European Commission 2017. Communication on The European Interoperability Framework- Implementation Strategy COM (2017) 134Annex 2 . Retrieved from: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52017DC0134
- Nan Zhang, Xuejiao Zhao, and Xiaope He 2020 Understanding the relationships between information architectures and business models: An empirical study on the

success configurations of smart communities Government Information Quarterly v37 (2), https://doi.org/10.1016/j.giq.2019.101439

- The Berlin declaration on digital society and value based digital government (German): https://www.bmi.bund.de/SharedDocs/downloads/EN/eu-presidency/berlin-declaration-digital-society

4.2. Ecosystem Transaction Management

Goals

Scaling of IoT- and AI-enabled services across many cities requires easy and risk-free access to suitable urban data sources that are already deployed in cities and communities today. A Digital Single Market within Europe – and extending to other areas with free-trading agreements such as Japan – allows for easy and risk-free access to relevant and available urban data, solutions and other resources so that services and solutions already deployed in other cities can easily be scaled and reach mainstream deployment. The use and re-use leads to new revenue streams incentivising the infrastructure owners to share data, analytics, services and/or solutions in infrastructure partnerships based on key technology enablers.

With a set of marketplaces established within the European Digital Single Market, and even beyond, all parties can co-create applications, solutions, services and guidelines on top of the common data models and standardised APIs. Facilitating this ecosystem of providers and consumers leads to sustainable business models and fair mechanisms for sharing and compensating, and it reduces the risk for investments.

Capabilities

The marketplace realizes standardized exposure of data and data sets guaranteeing security and privacy by design. The marketplace also realizes access to services that build on this data and transfer it to knowledge, intelligence and information for the consumers.

The marketplace provides catalogue management, ordering management, revenue (sharing) management, SLA management, quality management and data license management.

A crucial aspect of a market place is ecosystem transaction management. These functionalities enable effective matchmaking of urban IoT data sources from providers with respective data consumers, facilitate trusted exploitation of such data based on enforceable data usage agreements and secure value flow between these stakeholders.

There are various ways in realising such Ecosystem Transaction Management. A standardised way of doing so is provided by the TM Forum, who has created an API suite of specifications for digital marketplaces, named the Business API Ecosystem.

Recommended specifications

- Open & Agile Smart Cities (OASC) Catalogue: http://catalogue.city
- Basic Data Marketplace Enablers
  https://synchronicity-iot.eu/wp-content/uploads/2018/09/SynchroniCity_D2.4.pdf
- Guidelines for the integration of IoT devices in OASC compliant platforms
  https://synchronicity-iot.eu/wp-content/uploads/2018/09/SynchroniCity_D2.6.pdf
- TM Forum Open APIs and component suites provide a service and technology neutral suite of APIs that provide the minimum building blocks for interoperability

across all operational management areas. Each API and component suite provide the specification, reference implementations and in most cases conformance test kits. Reference Implementations are available under the Apache2.0 license. These APIs have gained global adoption in the Telecommunications industry and are proven to maximize reuse. They are designed to be extendable as required for specific services. The respective data models have been harmonized with FIWARE and GSMA data models. https://projects.tmforum.org/wiki/display/API/Open+API+Table

- OASC GitBook MIM3 page: https://mims.oascities.org/oasc-mim-3-contracts
- UDX (Urban Data Exchange) Catalogue: [COMING SOON]

Means of verification

To be included

4.3. Geospatial Information Management

The purpose of the Geospatial Information Management MIM (OASC MIM7) is to handle the geospatial data that is captured in a city. This goes from streetlights, buildings, streets to complete cities and regions. The goal of this MIM is to make this geospatial data interoperable with, within, and between cities. MIM7 was formally accepted as a Working Item during the 2021 OASC GA and will be developed further during the second part of 2021. This MIM will also provide input to the Data Models Layer, in the body of Geospatial Data Models.

5. Integrity Layer

The Integrity Layer consists of three MIMs focusing on the technical specifications for protection of digital rights (personal data, privacy, dignity, equality), transparency (societal governance of technology use and deployment), and security (systems and society).

5.1. Personal Data Management

Goals

Personal Data Management means providing clear and easy usable means for citizens/users to control which sets/attributes they want to share with solution-, application- or service providers under transparent circumstances, enabling trust between the different parties. Citizens should be able to identify themselves with an ID of their choosing and be able to transparently (dis)allow the service providers to access their data and control the granularity of the access (full, anonymously).

We see the following goals that need to be achieved:

- The right to have insight into what personal data is available, stored, shared, etc. by the providers of the applications and/or services in use;
- The right to change and/or delete part or all personal data available, stored, shared, etc. by the provider of the applications and/or services in use;
- A “permission arrangement” indicating in which circumstances what personal data is available to which parties;
- Consent from the users is asked and maintained by the providers of the applications and/or services, be it governmental or businesses, that attribute-based, decentralised storage and “revealing” of personal data attributes provides full service and access to these applications and/or services;
- Create a centralised authentication service that aggregates public and private identity providers and creates a keychain of identifiers to be used by applications;
- Ability to initiate or revoke the consent by the users to the party;
- The right to be forgotten by services;
- Be able to know in full transparency what data is tracked and stored from a user.

Capabilities

Personal data management systems need to be able to authenticate users based on a self provided identity, linking their data in full transparency and making sure that a user can manage the data that is collected and allow service and solution providers to access the data on the terms and conditions that the users decide. In some cases these systems need to be aligned with government initiatives like for example GDRP in Europe. Users also need the ability to determine the location and portability of the stored data, being able to choose where to store their health, insurance or mobility data.

These PDMs need to offer a machine-readable audit function for persons (and their representatives) to see personal data sets and activities relating to those data sets, e.g., operations involving aggregate data, like a search or analysis based on address/position/pseudo-ID)

Recommended Specifications

- The MyData.org initiative that allows users to select the data operator for their data https://mydata.org/wp-content/uploads/sites/5/2020/08/mydata-white-paper-english-2020.pdf
- IHAN as testbed for fair Data economy, introduction: https://www.sitra.fi/en/projects/testbed-for-fair-data-economy-ihanfi/

Means of verification

To be included

References

- MyData Declaration and Whitepapers
- MyData Architecture and Technical Specifications
- MyData as MIM4 Presentation by Kimmo Karhu, Head of Data at City of Helsinki
- Ihan.fi as Testbed for Fair Data Economy and Blueprint 2.5
- Buyle, R., Taelman, R., Mostaert, K., Joris, G., Mannens, E., Verborgh, R., & Berners-Lee, T. (2019). Streamlining Governmental Processes by Putting Citizens in Control of Their Personal Data. In A. Chugunov, I. Khodachek, Y. Misnikov, & D. Trutnev (Eds.), Proceedings of the International Conference on Electronic Governance and Open Society: Challenges in Eurasia (Vol. 1135, pp. 346–359). Springer International Publishing.
- Solid project and apps and Inrupt supporting the Solid project ecosystem
- On Digital Trust Infrastructure, "Proper data use in the public space" publication (in Dutch) which calls for research into a generic trust infrastructure in the public domain. In addition to recommending the inventorization and evaluation of digital infrastructure in the public space, it recommends "investigating possibilities for the realisation of a national, impenetrable and open digital trust infrastructure for identification, authentication and authorisation of personal data, including the related governance."
- When working on project architecture and use cases, reuse I Reveal My Attributes (IRMA) architecture and apps, from the (Dutch) Privacy by Design Foundation

5.2. Transparent Artificial Intelligence (AI)

Goals

Governments, including local governments, are increasingly seeking to capture the opportunities offered by automated decision-making using algorithmic systems, to improve their services. However, government agencies and the general public have justified concerns over bias, privacy, accountability, and transparency of such automated decision-making processes. New examples continue to emerge of potential negative consequences from the inappropriate use of ('black box') algorithms.

Here we define "Algorithmic System" as: "software that automatically makes predictions, makes decisions and/or gives advice by using data analysis, statistics and/or self-learning logic."

An automated decision-making algorithmic system does not necessarily require any form of self-learning logic (such as machine learning). In actual practice, software is often used that does not contain any self-learning logic, but the application of which may have great and sometimes unknown or unintended impact on citizens.

To provide citizens and governments at all levels with a proper process to mitigate risk, Amsterdam city council, along with some other cities, proposed the Fair AI MIM 5 as part of their work to develop a European norm for procurement rules for government agencies to use when procuring algorithmic systems to support automated decision-making. Alongside this, guidance is being developed in different global regions regarding the actions that government agencies themselves need to take to assess the level of impact and to make sure that automated decision-making is trusted, fair and transparent. This will include providing channels for citizens to query the decision-making process and involving citizens in co-designing the algorithmic systems. Most importantly there is the need to ensure that the data used by those systems is accurate and appropriate e.g. through publicly available algorithmic registries.

The OASC MIM 5 will match these activities by focusing on the technical capabilities required to check that the algorithmic systems offered by the supplier comply with the requirements for fairness, trustworthiness and transparency.

Capabilities

In order to match the procurement norm being developed, the following are the set of six minimal requirements for suppliers of algorithmic systems to ensure that these are fair, trustworthy and transparent.

Procedural Transparency

- Full disclosure of the type of choices made, parties involved, risks and mitigation actions in the process of creating an algorithmic model.

Technical Transparency

- Full disclosure to allow the buyer of the source code and model to enable them to explain the model to citizens or other stakeholders.
- Access to the learnings of the model, ideally structured using MIM2, to prevent vendor lock-ins.
- Clarity about the process by which an algorithmic system makes decisions in an overall system, ie. the optimisation goals and outcomes of an algorithm.

Technical Explainability

- Ability to explain on an individual level how a model creates certain outcomes.
- Ability to address any restrictions as to whom the information will be classified: public servants, other experts, etc.

Fairness

- Ensuring that the algorithmic systems do not systematically disadvantage, show bias against, or even discriminate against, different social groups and demographics.

Context

- However, the assessment of fairness depends on facts, events, and goals, and therefore has to be understood as situation or task-specific and necessarily addressed within the scope of practice. For instance, there may be an explicit goal to address an historic imbalance, where positive discrimination is considered appropriate. Here the aspect of “fairness” needs to be seen in the wider context.

Accountability

- Accountability for the supplier to create algorithms respecting human digital rights, and that is compliant with federal, state, and local anti-discrimination laws.
- Agencies should not procure algorithms that are shielded from an independent validation and public review because of trade-secret or confidentiality claims.
- It should be noted that these capabilities should be applied differently to different systems depending on the nature, context and goals of the algorithmic system.
- Technically, these capabilities can be translated into a metadata API that every vendor would provide, when supplying high impact algorithms to cities, and the buyers could put in their requirements when procuring.

Recommended Specifications

- Danish Standards PAS DS/PAS 2500-1: 2020, Artificial Intelligence – Part 1: Transparency; DS/PAS 2500-2: 2020, Artificial Intelligence – Part 2: Decision-support usage in public administration
- ITU-T Y.4470 Reference architecture of artificial intelligence service exposure for smart sustainable cities

Means of verification

To be included

References

- Standard Clauses For Procurement Of Trustworthy Algorithmic Systems: https://www.amsterdam.nl/innovatie/digitalisering-technologie/contractual-terms-for-algorithms
- White Paper on Public AI Registers: https://algoritmeregister.amsterdam.nl/wp-content/uploads/White-Paper.pdf
- Deliverables of the European Commission AI High-Level Expert Group (AI HLEG): https://digital-strategy.ec.europa.eu/en/policies/expert-group-ai
- Presentation democratic control over algorithms https://www.slideshare.net/OASC/fair-ai-democratic-control-over-algorithms
- Code for NL program "AI With Impact" (in Dutch)
- JRC: AI WATCH, specifically Task 6: AI in Public sector https://ec.europa.eu/jrc/en/publication/ai-watch-artificial-intelligence-public-sector
- European Commission 2019 Ethics guidelines for trustworthy AI
- On a policy level, the publication "Proper data use in the public space" (in Dutch) calls for social dialogue on AI in which a partnership is established among stakeholders including researchers, developers, policy makers and citizens. Key recommendations include:
    - Developing an Algorithm Reporting Framework (as well as a hotline)
    - Establishing a National Algorithm Register, linked to an Algorithm Forum
    - Drawing up an agenda of AI skills for trainers, politicians and policymakers
    - Exploring the impact of digitisation in the public space on the fundamental rights of citizens
    - Exploring the possibilities for certifying AI algorithms

5.3. Security Management

As cities become smarter and more technology-driven, they become a target for cyber attacks with significant consequences in terms of costs and loss of services. In order to deliver reliable digital services for citizens, cities have to continuously evaluate the cyber risks and to put in place security measures to prepare for cyber attacks. The objective of OASC MIM6, accepted as Work Item during the 2020 General Assembly, is to develop a methodology to help cities identify security-related risks and choose the right measures to protect their systems and data.

6. Impact Layer

The Impact Layer is driven by societal objectives with measurable outcomes towards those objectives, taking into account existing indicators, analytics, and resource management frameworks. It consists of three Work Items adopted during the OASC GA on 16 June 2021 and will be developed further in their respective Working Group. The focus for the June - December 2021 timeframe is to establish a workable baseline of references to open standards and best practices for each of these Work Items.

6.1. Ecosystem Indicator Management

Cities and towns are complex systems, and no two cities or towns are identical in the scale or scope of their complexity. Still, there is increasingly clear value when cities benchmark some measurements against comparable peer cities, as well as learn from the success and failures of other cities. Innovation ecosystems are no exception. The Ecosystem Indicator Management MIM adopted as Work Item aims to:

- Develop consistent measures of the ability of different cities to provide a healthy and effective ecosystem that nourishes digital transformation and supports interoperability of data, systems, and services;
- Govern cities' performance against these measures;
- Benchmark results and practices among comparable peer cities;
- Plan, deploy, and monitor ecosystem improvement initiatives.

6.2. Data Analytics Management

The Data Analytics Management MIM adopted as Work Item aims to make complex data models interoperable, allowing more efficient analytics and impactful exchange of expertise, to allow cities to leverage each other's successes in data analytics.

6.3. Resource Impact Assessment

The Resource Impact Assessment MIM adopted as Work Item aims to develop interoperable capabilities for management and assessment of scarcity and resources related to people, nature, and investment.