
Go Li.EU Deliverable 2.1

Technical specifications mapping (gaps between supply and demand side requirements)

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1 Summary

This report is dedicated to understanding the gaps between the supply and demand sides' requirements for technical specifications and standards in the context of technology procurements. This task was supported by a variety of data collection methods such as a survey, workshops and interviews. These methods granted the opportunity to interact with public (N=46) and private sector stakeholders (N=35) who have vast experience in technology procurement for smart communities. The interactions allowed a thorough analysis yielding the identification of commonly used technical specifications and standards alongside user experience testimonies. The report translates this into a concise gap analysis and finally concludes four recommendations:

- upskill civil servants
- promote the adoption of MIMs Plus
- Exchange best practices
- Rethink ICT procurement legislation

2 Context and background

The Technical Workig Group of the Living-in.EU movement is dedicated to enabling the digital transformation of European cities and communities. In doing so, it works towards solutions that promote interoperability and as such maintain European social, sustainable and cost-efficient values. As part of this effort,we leverage the working group and the environment of the movement to investigate the current use and usefulness of technical specifications and standards and thereby understand the requirements of smart city stakeholders. The results of this brief study will inform the development of the Minimal Interoperability Mechanisms (MIMs) Plus¹ which is currently in its 6.5 Version.

The MIMs Plus position themselves as a resource for cities to help in their procurement process for developing data-driven solutions and services. This effort is not unprecedented as there are a number of initiatives aiming to provide such help. In this spirit, the European Interoperability framework for Smart and Sustainable Cities (EIF4SCC)² was launched presenting a list of principles to guide communities development efforts. Communities then can use different technical specifications and European technical standards to match the principles. In this landscape, the MIMs Plus serve to bridge the gap between overarching European principles and the search for relevant technical specifications and standards.

2.1 Technology Procurement

Public administrations are facing many challenges when procuring technology, many of them specific to the nature of public procurement. Whereas any (large) organisation has to deal with challenges such as change management, integration, calculating total cost of ownership (TCO) and etc., public administrations are also confronted with the challenge of maintaining a level playing field and allowing market competition. In practice this comes down to finding a balance between being overly broad or overly specific when formulating a tender.

Some public procurement tenders for technology tend to let the market formulate the entire solution, and simply state the challenge, in some cases not even as detailed as functional

¹ <https://living-in.eu/group/7/commitments/mims-plus-version-6-final>

² <https://joinup.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory/news/connecting-eif-smart-cities-communities-eif4scc>

requirements. While this greatly promotes competition, it can lead to situations in which the integration with the ICT landscape of the procurer is very expensive or nearly impossible. In this kind of cases, it is paramount to try to assess the total cost of ownership (or total cost of integration) of the solution within a complex ICT architecture. This is not an easy feat, certainly when also considering potential future developments or procurements. In some cases, such a “broad” tender is produced, simply because of the lack of technical know-how within the administration. While ideally, market competition would make sure that a sufficient solution is found at the most cost-effective price, in this case, it often leads to higher costs overall for maintaining the complete technical architecture of the administration. This is one of the reasons many procurers rely on standards and best practices to include in their tender documents. In some cases, there are national or regional “template clauses”, such as the OSLO³ standards in Flanders.

On the other hand, some technology procurements may be overly specific, which limits the number of suppliers that may respond to them drastically. This may be the result of a very strict architectural vision, or might be the result of a vendor lock-in. In the latter case, the total cost of ownership of the ICT architecture may again be out of bounds, because vendors know that there are no competing solutions, thus allowing them to drive up the price. Limiting the ICT landscape of an administration to a small set of solutions, provided by a small set of vendors, may reduce integration costs in the short term, but in the long term, specific features or ad-hoc requirements may be costing the administration for more than the market average. Even worse, it makes the move to a competing solution very difficult and costly, which results in a deadlock and undermines the concept of a level playing field.

It is crucial to strike a balance between these two approaches. Therefore, the Living-in.EU Technical Working Group has set out to identify appropriate technical specifications to include in procurement, and, more importantly, for the gaps that exist between the expectations of the demand side and the supply side of said specifications. For this assessment, the report also bears in mind the two types of procurement processes: fixed and open. The former is typically used for procuring infrastructures and it implies a set price. Respondents will be evaluated against this price, and the one with the best service value is selected. The latter prioritised the quality of the application with the help of a jury. In this scenario the applicant sets the price.

2.2 What are “Technical Specifications”

“Technical Specifications” as a term is a broad concept. In order to fully understand the challenges cities and communities are facing when formulating technical specifications in procurement, it is necessary to break this concept down along a number of dimensions. We define two such dimensions, being **specificity** and **subject matter**. In terms of specificity, we can identify a variety of types of specifications, which we can classify across a scale going from more conceptual to more practical. In terms of subject matter, we classify the identified specifications across different technical domains. These dimensions are interrelated, in the sense that lower levels of specificity (such as high-level “principles”) may apply to many different subject matters, while very specific technical specifications are often related to only one.

Dimensions

Specificity

³ <https://www.vlaanderen.be/digitaal-vlaanderen/onze-oplossingen/oslo>

First of all, we want to discern different levels of “specificity”. As mentioned earlier, public administrations try to maintain a fine balance between being too broad, thus introducing high integration costs and a scattered ICT landscape and being too specific, limiting market competition and potentially resulting in (or stemming from) a vendor lock-in. We discern three different levels of specificity. Lower specificity means higher levels of abstraction and vice versa. From low to high levels of specificity these are:

1. Principles: EIF4SCC

The highest level of abstraction, or lowest level of specificity, is that that defines a set of principles for the technology being procured. A great example of this the European Interoperability Framework for Smart and Sustainable Cities and Communities, or EIF4SCC:

While an European Interoperability Framework EIF for eGovernment has been in place since 2004 local context was not included. Therefore, EIF4SCC aims to provide EU local administration leaders with definitions, principles, recommendations, practical use cases drawn from cities and communities from around Europe and beyond, and a common model to facilitate delivery of services to the public across domains, cities, regions and borders.

The EIF4SCC bundles 3 concepts, 5 principles and 12 recommendations:

1. Human Centric Approach
 - a. Ensure that inhabitants and visitors play an active role by connecting, engaging and enabling them in policy-making, co-creation and testing of solutions for SCC.
 - b. As far as possible under the legislation in force, ask cities/communities service users onceonly and relevant-only information, ensuring a fully transparent process on how data is used
 - c. Ensure that accessibility (including for people with disabilities, the elderly and other disadvantaged groups) is taken into consideration during the procurement, design, development, implementation and monitoring phase of service provision, including by following e-accessibility specifications at regional, national, European or international level
2. A city needs-led approach at EU level
 - a. Endorse and join existing forums, networks and working groups, at local, regional, national and European level⁴ to boost cooperation, collaboration, join forces, discuss and share experiences and best practices and build upon the knowledge and experience already available
3. The city as a participatory-driven and open innovation ecosystem
 - a. Ensure collaboration and communication between inhabitants, business, visitors, organisations and city/community administrators, in your city/community, so that different needs (e.g. assisted living, social care, health, education, culture and environment), challenges and requirements are addressed in a collaborative way by involving stakeholders with all the necessary competencies and/or skills in the co-creation and co-production of services
 - b. Foster an open innovation ecosystem (such as local living labs, digital innovation hubs) to ensure that the local community is actively involved in creating new and scaling up solutions
4. Ethical and socially responsible access, use, sharing and management of data and technology
 - a. Make sources of information (base registries, open data portals, etc.) available to inhabitants, business, visitors, organisations and city/community

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- administrators ensuring security, trust and privacy in accordance with the relevant legislation and contribute to the EU data space for climate neutral and smart communities
 - b. Ensure that digital rights are respected during the design, development, implementation and monitoring phase of the services provision (including GDPR issues)
 - c. Ensure transparency on data sharing collaborations between and within government, citizens, businesses and organisations
 - 5. Technologies as key enablers, not as the objective
 - a. Use open standards and open technical specifications when developing local data platform and services, include multiple access and assistance channels to ensure that users can choose the option that best addresses their needs and/or preferences
 - b. Implement seamless solutions at the service of inhabitants, businesses, visitors, organisations and city/community administrators, leveraging advanced technologies (such as IoT, blockchain, AI, etc.) Set-up or consolidate interoperable local data platform(s) that integrate and reuse data in cities and communities by stakeholders, and promotes open standards and open technical specifications, APIs and data models to provide a holistic view of the information. This aims to support the decision-making process and to foster innovation and citizen engagement.

The EIF4SCC further extends the traditional “4 layers” of interoperability model by defining 7 “elements”, and it includes guidance on how to implement interoperability across all of them.

Whereas these are very useful principles, which can guide the development of smart city solutions, they are hardly fit to be integrated directly into public procurement. Instead they provide the procuring party with an overview of interoperability concerns to take into account during the design, development, implementation and assessment of any smart city solution or program.

Our research reveals that procuring governments need more concrete and detailed guidance when it comes to define interoperability requirements within a tender. This brings us to a second, more specific set of approaches.

For more information on how the EIF4SCC relates to these approaches, please refer to section 3.3 and the workshop conducted with Wavestone

2. Approaches

- MIMs Plus

The minimal interoperability mechanisms (MIMs)⁴ emerged to enable a minimal but sufficient level of interoperability for data, systems, and services specifically in the context of smart city solutions. By facilitating this minimal yet essential level of interoperability, the MIMs pave the way for the development of a cohesive global market and collaboration centred around solutions, services, and data.

The European Union is fully committed to enabling a level playing field for technology suppliers and buyers, and has issued many policies to maintain it. The MIMs are adopted and refined by

⁴ <https://oascities.org/minimal-interoperability-mechanisms/>

the European Commission in the form of the MIMs Plus⁵, and these are governed by the Living-in.EU movement.

- PPIs

Pivotal Points of Interoperability (PPIs)⁶ (NIST) refer to key areas or components within a system or network where interoperability is crucial for seamless communication and integration between different entities or systems. These points are pivotal because they often serve as the interfaces or connectors between various subsystems or entities, facilitating data exchange, communication, and collaboration.

In the context of technology or information systems, PPIs can include interfaces, protocols, standards, or APIs (Application Programming Interfaces) that enable different software or hardware components to interact and exchange data efficiently and effectively. Ensuring interoperability at these pivotal points is essential for enabling seamless integration, scalability, and flexibility in complex systems or networks of diverse components from different vendors or sources.

3. Standards, formats and specifications

Technical standards, formats, and specifications are crucial components in various industries, ensuring compatibility, interoperability, and quality across products, systems, and processes. Here's an overview of each:

Technical Standards: These are established norms or requirements that products, services, or processes must meet. They are developed and maintained by standardisation organisations, industry consortia, or regulatory bodies. Standards can cover a wide range of areas, including dimensions, performance, safety, compatibility, and more. Examples include ISO (International Organization for Standardization) standards, IEEE (Institute of Electrical and Electronics Engineers) standards, and ASTM (American Society for Testing and Materials) standards. Adherence to standards helps ensure consistency, reliability, and quality across different products and systems.

Formats: Formats refer to the specific structure or arrangement of data, files, or documents. They define how information is organised, encoded, and represented. Formats can be applied to various types of data, including text, images, audio, video, and more. Common formats include JPEG for images, MP3 for audio, PDF for documents, and MPEG for video. Choosing the appropriate format is important for compatibility, efficiency, and ease of use. Formats may also have associated standards or specifications that govern their implementation and usage. In terms of data exchange, most information is still formatted in textual formats, structured along different kinds of “serialisations”, that allow expression complex data structures in simple textual “strings” (consecutive lists of characters) such as:

- JSON
- XML
- RDF

Specifications: Specifications are detailed descriptions of the requirements, characteristics, and features of a product, system, or component. They provide a clear and precise definition of how

⁵ <https://living-in.eu/group/7/commitments/mims-plus-version-6-final>

⁶ <https://www.nist.gov/news-events/news/2021/11/nists-pivotal-points-interoperability-enable-smart-city-standardization>

something should be designed, manufactured, or implemented. Specifications can cover various aspects, such as dimensions, materials, performance metrics, interfaces, and functionality. They serve as a blueprint for developers, engineers, and manufacturers to ensure that their products or systems meet the desired criteria. Specifications are often developed by industry organisations, governmental agencies, or individual companies.

It is important to note that specifications are different from standards, because specifications can be defined by anyone, any company or organisation, and are not necessarily agreed upon by third parties. Standards, on the other hand, are defined and governed by a Standards Bodies or Standard Developing Organisations (SDO's), and have been agreed upon by a large number of stakeholders

Subject matter:

The second dimension we use in our approach to analyse requirements for technical specifications, are the subject matter themes of technology procurement. We identify three broad categories of subjects that benefit from technical specifications: Data, Infrastructure, and Quality of Service (QoS). We define these as the following:

1. Data

An often recurring challenge in formulating technical specifications in procurement is the way data is to be handled. This may include exchange specifications, data formats, etc. Furthermore, the ownership of data and their lifecycle in general (such as retention times, backup frequency and so on) needs to be specified in order to avoid data loss and to comply with regulations.

2. Infrastructure

A second important subject matter that is often part of procurement processes is the infrastructure on which the solution is supposed to run. Typically, this includes the “cloud or on-premise” discussion, more specifically, will the solution be run and maintained by the solution provider on a cloud infrastructure, and is this feasible within existing European GDPR regulations? Or will the solution be installed on the procuring party’s premises, within their own data centre, etc. In the latter case, clear specifications need to be formulated on the hardware, operating systems, network infrastructure and upgrade paths. Another point of attention for this subject is security: if the software is run on the cloud (as a Software as a Service or “SaaS”), can the supplier guarantee that this is in line with the procurer’s security policy? This security discussion is strongly linked with the Quality of Service the supplier is able to provide (see further)

3. Quality of Service (QoS)

The classical definition of QoS pertains to telephony and Internet Provider’s performance, essentially limited to uptime, latency, and similar concepts. However, for the sake of this research, we want to extend *Quality of Service* to include all specifications that are not strictly related to a specific technology or system, but rather to the overall quality of the solution. When crafting a tender with QoS considerations, it's crucial to specify performance metrics like response time and availability, along with SLAs outlining uptime guarantees and penalties for non-compliance. Scalability requirements should be defined to accommodate future growth,

while reliability, redundancy, and security measures are essential to ensure uninterrupted service and protect sensitive data. Interoperability with existing systems, ongoing support, and considerations for end-user experience should also be included to select solutions that align with performance, reliability, and usability requirements, ultimately ensuring optimal ICT procurement outcomes.

3 Methodology

To gather a broad range of input for this research, a comprehensive methodology was developed, which involved a structured approach integrating workshops, interviews, and a survey to gather input from both supply-side and demand-side participants. It begins with defining objectives and identifying stakeholders, followed by separate workshops for each perspective, facilitated discussions, and collaborative activities. Stakeholder interviews capture individual insights, while survey questionnaires reach a wider audience, with findings synthesised to identify common themes and divergence

	Demand side participants	Supply side participants
Survey	14	14
Workshop 29.01.2024	29	0
Workshop 06.11.2023	0	13
Workshop 15.03.2024	0	5
Interviews	3	3
Total	46	35

Table1: Overview of all participants across the three activities this report is based on

3.1 Survey

The survey was conducted between October 1st and 20th, 2023, targeting Living-in.EU members, OASC, ENoLL, and CEMR networks. The 28 responses generated insights on the relationship between formal standards and industry specifications in Europe.

The survey was designed to make it accessible to the variety of stakeholders within the smart communities. As such, the results provided a preliminary insight into the community's:

- affinity with technical standardisation
- familiarity with the MIMs Plus
- attitude towards technical standardisation
- activities pertaining to technical standardisation.

The survey was divided into three parts, with an introduction to explain the scope of the survey and state relevant GDPR regulations. Part 1 gathered respondent profiles and assessed their familiarity with MIMs Plus, directing them to subsequent sections based on their role as users or developers of standards, or both. Part 2 targeted standardisation providers/developers, probing into the scope of their activities at national, European, or international levels, their involvement in specific standards, and their interest in standardisation work. Part 3 focused on standardisation users/awareness, investigating the extent of technical standards' usage,

preferences for national, European, or international standards, and specific standards and standardisation organisations they engage with.

3.2 Workshops

Technical Working Group Meeting

29.01.2024

The workshop hosted 29 participants from various European public organisations that are part of the Living-in.EU technical working group. The workshop was co-organised with representatives from Wavestone⁷ who are involved in the National Interoperability Framework Observatory (NIFO⁸) activities. The scope of the workshop was to understand how communities use the EIF4SCC and the MIMs Plus in reality and thereby understand what are their requirements for technical standards and specifications. In doing so we looked at the EIF4SCC's principles and elements (figure 1).

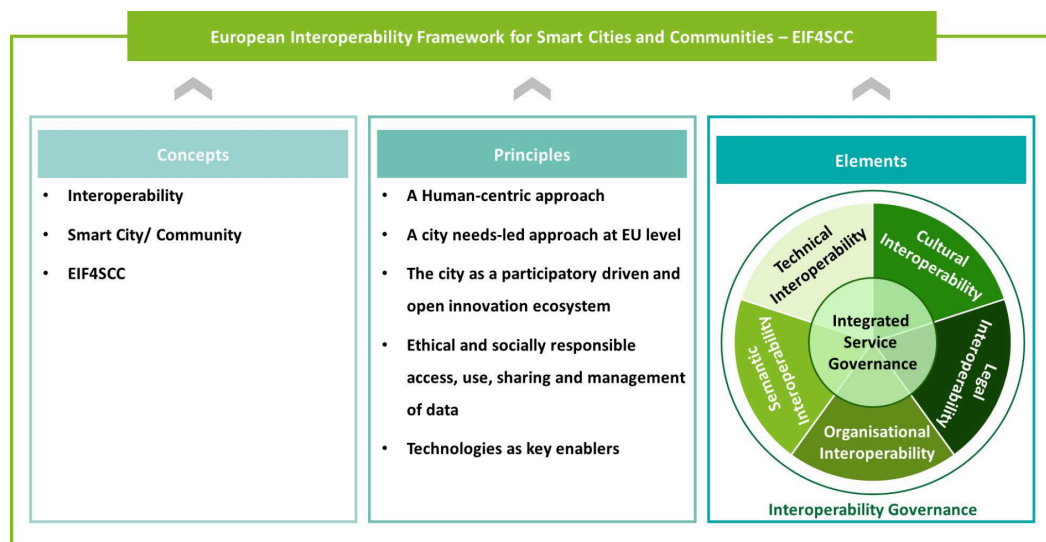


Figure 1: European Interoperability Framework for Smart Cities and Communities - EIF4SCC⁹

Supporters Meeting

06.11.2023 & 15.03.2024

This workshop was organised twice to increase the volume of input. The first session welcomed 13 participants and the second session 5 participants. The workshop was led by OASC representatives, and explored the commonly used technical standards and specifications by European organisations and related issues. The workshop also provided the opportunity to learn about their requirements and current gaps in the landscape of European technical standards and specifications. The workshop was facilitated with the use of a MIRO board to document mentioned standards and specifications.

3.3 Interviews

⁷ <https://www.wavestone.com/en/>

⁸ <https://joinup.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory>

⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A52022SC0710>

While the workshops served to provide an understanding of the experience of the supply and demand side with technical standards and specifications, the interviews looked at their practical use for developing technology for governments. As such, interview subjects were either issuers or respondents of public procurements for technology. As such, the results reflected the challenges and requirements of both groups. On one occasion, we had the opportunity to interview both the issuer and the winner of the same procurement call.

All interviews were held online using Zoom, and were recorded following a written consent from the participant. The conversations took 30 minutes to an hour exploring the data, interface, and service aspects of procurements.

In total this report leverages on the input of five interviews:

Name of organisation	Country	Issuer/ Responder
Rockwood Digital Europe	Hungary	Responder
Endeva	Slovakia	Both
Vaasa	Finnland	Issuer
Wapice	Finnland	Responder
Ghent	Belgium	Issuer

Table 2: Overview of Interview Subjects

The interview questions aligned with the subject matters of a procurement call. Both groups of interview profiles were asked the same questions.

Subject Matter	Questions
Context	Could you elaborate on your experience in public procurement?
Data	Could you elaborate on the technical specifications used for data?
	Could you elaborate on the specificity of these specifications?
Infrastructure	Could you elaborate on the technical specifications used for infrastructure?
	Could you elaborate on the specificity of these specifications?
QoS	Could you elaborate on the technical specifications used for quality of service ?
	Could you elaborate on the specificity of these specifications?

Table 3: Interview Questions

The interview results were then qualitatively coded. Qualitative coding is a process of systematically categorising excerpts throughout the data - the interviews- to identify themes and patterns.

4 Results

Survey

Respondents call for increased involvement to ensure challenges faced by knowledge workers are heard by standard bodies and tech providers. They emphasise the need for clear, concise use cases over lengthy manuals to illustrate standards' practical applications, advocating for widespread sharing. Additionally, there's a plea for thorough examination of existing standards before developing new ones, promoting re-use and interoperability solutions. In essence, the survey underscores the importance of active involvement, clear use cases, and re-use of existing standards to facilitate implementation across European smart cities and communities.

4.1 Demand Side Requirements

Workshops

This workshop looked at the implementation of the EIF4SCC and the use of relevant MIMs. In doing so, participants could reflect on their challenges and needs to implement the 7 principles of the EIF4SCC.

Principle	Use	Comments/Best Practices
Human-centric approach	12	<ul style="list-style-type: none"> • A consortium must have (1) experience), (2) representation and (3) legitimacy • Standards isn't always enough, but a good "floor" • Accessibility is implemented with WCAG
A city needs-led approach at EU level	6	<ul style="list-style-type: none"> • Join a practical community, like Living-in.EU and OASC/DS4SSCC-related Stakeholder fora
A city as a participatory-driven and open innovation ecosystem	6	<ul style="list-style-type: none"> • Get active in/facilitate local/regional/national/EU/global fora • Management buy-in • There are a number of Living Labs in Ghent on different theme's • Practice makes better – nobody's perfect • We are implementing a method for our colleagues to work with innovation and participation: https://innovationsguiden.se/ https://goteborg.se/wps/portal/start/kommun-och-politik/politik-och-demokrati/sa-kan-du-paverka-och-vara-delaktig/medborgardialog • Within the vCity project (https://www.vcity.tech), we are fostering the ecosystem of urban digital twins
Ethical and socially responsible access, use, sharing and management of data and technology	12	<ul style="list-style-type: none"> • We have a city open data portal. goteborg.se/psidata • We have a large open data work that is national that we create and implement standards. FIWARE, and others. dataverkstaden.se

		<ul style="list-style-type: none"> • eesti platform / x-Road ecosystem • Denmark has both OS2 and Open Data DK • data.stad.gent
Technologies as key enablers, not as an objective	10	<ul style="list-style-type: none"> • Y.MIM • U4SSC Minimal Interoperability Recommendation (report) • Our open data standards for some datasets. • https://www.vgregion.se/ov/dataverkstad/data_mangder/ National work sweden. We have workshops and speakers come talk to us in the Region where I live so that we all can get organised and work smarter. • Linked to call for tenders • Danish Standards' Guide to Sustainable Digital Transformation • Smart Data Models • OSLO standards • ISA² initiative

Table 4: Living-in.EU Technical Working Group Workshop Results Part 1

Interoperability Layer	Use	Comments/Best practices
Organisational	2	<ul style="list-style-type: none"> • Management buy-in • Diversity • Safe working environment • Clear roles and goals
Legal	3	<ul style="list-style-type: none"> • Build legal experience and capacity to deal with the EU dimension (state aid etc.)
Semantic	2	<ul style="list-style-type: none"> • Minimal (but sufficient) interoperability – no single ontology will rule them all • LDES • Do we need a crawler for the semantic web? • This would help us a lot when building services together as a europe • Linked Data • Using semantic web approach • Using DCAT-AP for metadata • Creating specifications for data sharing using vocabularies and URIs
Cultural	2	<ul style="list-style-type: none"> • Experience • Cultural diversity in the organisations • Flexible tools (so that they do not impose a particular cultural or organisational approach)
Technical	8	<ul style="list-style-type: none"> • Same references as above (or wherever it is)

Table 5: Living-in.EU Technical Working Group Workshop Results Part 2

Interviews

The interviews were set up to gain more insight into the experience of civil servants or other subjects experienced in issuing procurement calls generated the following codes.

Subject matter	Code
Data	<ol style="list-style-type: none"> 1. No/few guidelines, public institutions are independent 2. need for specifications 3. MIMs are useful 4. openness 5. avoid vendor lock-in 6. data formats: MQTT, CoAP, DDS, AMQP 7. Data models: JSON 8. FIWARE can cause problems with the application layer
Infrastructure	<ol style="list-style-type: none"> 9. Use of guidelines 10. use of software 11. cloud-based 12. GDPR requirements
QoS	<ol style="list-style-type: none"> 13. SLAs: up-time, reaction to malfunction 14. cyber security

Table 6: Interview results based on input of the demand side

4.2 Supply Side Requirements

Workshops

The Living-in.EU supporters meetings provided a list of standards and specifications across the following topics: technical standards, cities & communities, energy, mobility, green deal, skills, and cultural heritage. No specifications or standards were listed for the domains of tourism, health and manufacturing. In total 39 standards and specifications were discussed. It was due to the time limit that relevant issues and gaps were not identified.

Domain	Standards & Specifications	Issues	Gaps
Technical Standards	NGSI-LD ¹⁰	Coordinate Reference System	-
	WebOfThing (W3C) ¹¹	Nordic group started it	-
	DCAT-AP ¹²	Different local application profiles	-

¹⁰ https://fiware-datamodels.readthedocs.io/en/stable/ngsi-ld_howto/

¹¹ <https://www.w3.org/TR/wot-thing-description11/>

¹² https://ec.europa.eu/isa2/solutions/dcat-application-profile-data-portals-europe_en/

	GeoJSON ¹³ , OSLO (Flanders) ¹⁴ , OGC APIs ¹⁵ , Geopackage ¹⁶ , INSPIRE ¹⁷ , Core Vocabularies, WFS ¹⁸ , SHP files ¹⁹ , REST ²⁰ , IEC 63205 Smart City ²¹ , GeoDCAT-AP ²² , StatDCAT ²³ , ISO27001 ²⁴ , ETSI oneM2M ²⁵ , ISO IEC 30141-IoT Reference Architecture ²⁶ , EN 301 549 Accessibility ²⁷ , ISO IEC 30188 Digital Twin Reference Architecture ²⁸ , ISO/IEC CD 30149 Trustworthiness principles ²⁹	-	-
Cities & Communities	SALAR RefARK ³⁰		-
	CityGML ³¹ , CityJSON ³² , SAREF ³³ , ISO/IEC 5087 Series of City Data Standards ³⁴ , Smart City Maturity Model ³⁵ , IEC Mapping Platform ³⁶	-	-
Energy	CEN/CENELEC ³⁷ , EV CHARGING -	EV Charging	-

¹³ <https://geojson.org/>

¹⁴ <https://joinup.ec.europa.eu/collection/oslo-open-standards-local-administrations-flanders>

¹⁵ <https://ogcapi.ogc.org/>

¹⁶ <https://www.geopackage.org/>

¹⁷ https://knowledge-base.inspire.ec.europa.eu/index_en

¹⁸ <https://www.ogc.org/standard/wfs/>

¹⁹ <https://doc.arcgis.com/en/arcgis-online/reference/shapefiles.htm>

²⁰ <https://www.redhat.com/en/topics/api/what-is-a-rest-api>

²¹ https://www.iec.ch/dyn/www/f?p=103:38:0:::FSP_ORG_ID,FSP_APEX_PAGE,FSP_PROJECT_ID:13073,23,102105

²² <https://joinup.ec.europa.eu/collection/semic-support-centre/solution/geodcat-application-profile-data-portals-europe>

²³ <https://joinup.ec.europa.eu/collection/semic-support-centre/solution/statdcat-application-profile-data-portals-europe/release/100>

²⁴ <https://www.iso.org/standard/27001>

²⁵ <https://portal.etsi.org/Services/Centre-for-Testing-Interoperability/Activities/M2M/oneM2M>

²⁶ <https://www.iso.org/obp/ui/#iso:std:iso-iec:30141:ed-1:v1:en>

²⁷

²⁷ <https://www.etsi.org/human-factors-accessibility/en-301-549-v3-the-harmonized-european-standard-for-ict-accessibility>

²⁸ <https://www.iso.org/standard/53308.html>

²⁹ <https://standict.eu/standards-repository/isoiec-cd-30149-2022iot-trustworthiness-principles>

³⁰ <https://inera.atlassian.net/wiki/spaces/AR/pages/2835054927/Reference+architecture+IoT>

³¹ <https://www.ogc.org/standard/citygml/>

³² <https://www.cityjson.org/>

³³ <https://saref.etsi.org/>

³⁴ <https://smartcities.ieee.org/resources/webinars/introduction-to-the-iso-iec-5087-series-of-city-data-standards>

³⁵ https://www.smart-city.uliege.be/cms/c_9277570/en/smart-city-maturity-model

³⁶ <https://mapping.iec.ch/#/maps>

³⁷ <https://www.cenelec.eu/>

	NOBIL.NO ³⁸ , IEC 61970-301:2020+AMD1:2022 ³⁹		
Mobility	DATEX II ⁴⁰ , GTFS ⁴¹ , ITS Standards ⁴² , Dom ⁴³	-	-
Green Deal	SensorThings ⁴⁴ , SOSA ⁴⁵	-	-
Skills	ESCO ⁴⁶	-	-
Tourism	-	-	-
Health	-	-	-
Manufacturing	-	-	-
Cultural heritage	PROV ontology ⁴⁷	-	-

Table 7: Living-in.EU Supporters Meeting Workshop (Aggregated) Results

Interviews

The interviews with subjects experienced in answering procurement calls generated the following codes.

Subject matter	Code
Data	<ol style="list-style-type: none"> 1. need for guidelines 2. need for maximum specifications 3. MIMs are useful 4. describe business advantage form the use case 5. familiarity with: FIWARE, TalQ2.0 protocol, MQTTD, JSON, open API standards 6. need to address risks: ISO27001 and NIS2 directive
Infrastructure	<ol style="list-style-type: none"> 7. it is more concrete than data 8. visual architectural overview of current and expected architecture 9. need for maximum specifications
QoS	<ol style="list-style-type: none"> 10. lack of understanding of the associated costs of the demanded services

³⁸ <https://info.nobil.no/english>

³⁹ <https://webstore.iec.ch/publication/74467>

⁴⁰ <https://datex2.eu/>

⁴¹ <https://gtfs.org/>

⁴² <https://www.itsstandards.eu/>

⁴³ <https://www.w3.org/TR/WD-DOM/introduction.html>

⁴⁴ <https://www.ogc.org/standard/sensorthings/>

⁴⁵ <https://www.w3.org/TR/vocab-ssn/>

⁴⁶ <https://esco.ec.europa.eu/en>

⁴⁷ <https://w3.org/TR/prov-o/>

	11. use SLAs 12. need for maximum specifications
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Table 8: Interview results based on input of the supply side

5 Analysis

5.1 Technical Specifications

The table below summarises the conclusions we can draw from these contributions across the two initial dimensions, being **specificity** and **subject matter**. In general, there seems to be less discrepancy between the supply and demand side for infrastructure-related requirements, possibly because this is for a more monopolised market, whereas in terms of data requirements, both supply and demand side would like to see more concrete terms. When we look at QoS specifications, it is clear that the terms are well understood, but the cost of realising them may be exorbitant in relation to the use case. It may be argued that in this case, procurers should make a more granular assessment of the QoS they are requiring in relation to the solution they are procuring. A general impact assessment may serve to address this. An overview:

	Data	Infrastructure	QoS
Principles	Openness and Interoperability are key requirements in all tenders. Compliance with GDPR and data ownership are the second most important requirements.	Cloud vs. On-premise infrastructure dictates most of the requirements. Most procurers that do not (or can not) require on-premise hosting ask for proof or certificates for compliance with regulations.	There is a clear trade-off between QoS requirements and price. In order to find the optimal supplier, these needs need to be balanced. At times procurers overstate the QoS requirements without fully considering the use case.
Approach	Many procurers refer to an intermediary mechanism or principle (such as FAIR) to make sure solutions allow interoperability, without fully grasping the impact or feasibility of it. Later integrations with other systems continue to be challenging	In the realm of infrastructure procurement, standards are far more developed. This makes it easier for procurers to require compliance. For data centres specifically, ISO 9000 ⁴⁸ , ISO	There are many high-level approaches to ICT QoS management, such as ITIL ⁵¹ , CMMI ⁵² , etc. More recently, approaches such as Agile ⁵³ and DevOps ⁵⁴ have taken on the challenge to having a more flexible and

⁴⁸ <https://www.iso.org/standards/popular/iso-9000-family> (Quality)

⁵¹ <https://en.wikipedia.org/wiki/ITIL>

⁵² <https://cmmiinstitute.com/>

⁵³ <https://www.agilealliance.org/agile101>

⁵⁴ <https://en.wikipedia.org/wiki/DevOps>

		14000 ⁴⁹ and ISO 27001 ⁵⁰ are often cited. Nevertheless, when procuring hardware, there is a tension between procurers wanting a specific brand or make, and suppliers arguing they could formulate an alternative.	dynamic take to QoS mgmt, and provide a more cost-efficient quality of service.
Standards / Specifications	Very few procurers are mentioning literal data formats or standards in their tenders. This is partly due to the lack of their knowledge of the domain, and partly because of the fear of favouring specific suppliers. While it is indeed true that many suppliers are imposing their own data formats, it can be argued that this is a subject matter that is best governed by the procuring party, because otherwise, integration costs with existing or future software may skyrocket.	In terms of standards and specifications, the infrastructure market is far more consolidated. Unfortunately, this leaves very little opportunity for new and small players to be selected, but on the other hand, this also greatly reduces the integration costs for public sector procurers. Globally, the ICT hardware market has been monopolised, but the networking and software infrastructure market are still fully divergent. The public sector can play a key role in ensuring open and transparent standards are encouraged.	QoS requirements are seldom mentioned in public procurement tenders in this level of detail. Since QoS is a technology agnostic concept, this would make little sense. Sometimes, procurers would like to be able to benchmark their QoS to other suppliers, but this is dependant on so many factors, that defining a

Table 9: Analysis of results part 1

5.2 Identified gaps

Subject Matter	Supply	Demand
Data	Solution providers are, in	In very few cases, procurers are

⁴⁹ <https://www.iso.org/standards/popular/iso-14000-family> (Environment)

⁵⁰ <https://www.iso.org/standard/27001> (Security)

	<p>general, in favour of more specific requirements for data exchange and formats. Many providers consider it to be either of little or no effort to supply data in a certain format or standard, when it is made explicit in the procurement. Some however, may be reluctant to apply because they consider their solution (suite) as self-contained components which require proprietary formats.</p>	<p>willing or able to formulate requirements for data formats or standards. The main drivers for this are the fear of limiting the market, and the lack of internal knowledge on this subject matter. Often, local authorities refer to principles or standards set by their respective regional or national governments. In practice, when leaving data formats and models up to the suppliers, this can quickly result in a vendor lock-in.</p>
Identified Gaps	<ul style="list-style-type: none"> • Lack in the know-how of procurers about domain-specific data specifications, formats and standards (Code 1, Code 2)⁵⁵ • Difficult to assess whether a proposed format or specification is commonly used (within a domain) or vendor-specific (Code 2) • Hard for suppliers to assess the exact data needs of the procurer without technical specifications (Code 2, Code 4) • Need for a “repository” or approach to assess whether proposed specifications are open, commonly used, and applicable (Code 3) 	
Infrastructure	<p>While specifications for infrastructure are much better understood, and compliance mechanisms are often in place, for most infrastructure providers, it is still hard to assess whether it makes sense to submit a quote because procurers often have a specific vendor, brand or make in mind. Moreover, many procuring authorities are making use of framework contracts, potentially together with other authorities, so actual procurement is rare. Another recurring challenge for vendors is to assess the existing infrastructure architecture within the procuring party. While some standards exist to describe this, a visual diagram is</p>	<p>Procurers typically seek infrastructure providers when a depreciation period comes to an end. They often rely on framework contracts and group buying instead of procuring alone. Since infrastructure, especially hardware, is a much more consolidated market, standards are quite mature, but this also implies the chances for new and smaller players to enter this market are small. Since the competition is mostly focussed on price, it is also hard for suppliers to differentiate, for instance on sustainability or service after procurement. When only part of the infrastructure is being replaced or upgraded, in-depth discussions with suppliers are needed to convey their needs.</p>

⁵⁵ These codes refer to the codes extracted from the interviews in section 4.2

	still the most	
Identified Gaps	<ul style="list-style-type: none"> • Communicating the existing infrastructure architecture is an issue (Code 8) • Lack of simple way of describing the existing and expected infrastructure architecture (Code 9) • Sustainability requirements are quickly developing, but are often only an afterthought since competition is mostly about price • It is difficult for new and smaller players to enter this market or to differentiate from their larger competitors. 	
QoS	Clear trade-off between QoS requirements and price, but this is not always well understood by procurers.	Often not very differentiated requirements, nor tailored to the use case
Identified Gaps	<ul style="list-style-type: none"> • Do not use one-size-fits-all procurement annexes or templates. • Differentiate based on the use case, do a risk analysis (risk x impact) for each individual component of the solution instead asking premium support • understanding of costs versus service: slightly better service may require a new technical approach. 	

Table 9: Analysis of results part 2

6 Conclusion

The nature of public procurement causes restrictions for public bodies. Often, procurers have limited technical experience, which causes them to refrain from mentioning specific technical standards and specifications. The idea might be that this allows for more market competition, but in fact, by avoiding specification in the procurement process, the chance of getting in a vendor lock-in situation increases, and thus does **not** contribute to the creation of a level playing field.

6.1 Recommendations

The survey, workshops and interviews provided this report with the opportunity to define a number of recommendations anchored in the requirements of the demand and supply side. These recommendations refer to the issuing of procurements and as such are best suited to be used by local administrations.

Upskill civil servants

‘Join a practical community, like Living-in.EU and OASC/DS4SSCC-related Stakeholder fora’
 Living-in.EU Technical Working Group Workshop
‘We need to enlighten our staff and departments in the city HOW valuable the sharing of ideas are so that we can build smart and creative services for the citizens.’
 Göteborg, Living-in.EU Technical Working Group Workshop

Responses echoed the need to educate and upskill civil servants. Such efforts should pertain to the familiarity with solutions from other communities but also to have a general understanding

of the benefits and risks technologies can hold for the community and its citizens. While this recommendation is not an unprecedented finding, it underlines the continued need to invest into capacity building.

Promote the adoption of MIMs Plus

'As a tenderer it is not sufficient information because general legislations allow for too many solutions. The MIM approach should be taken further - that is between too precise (which cannot happen) and too little. But MIM should be clarified further (self-describable) - as it is now it is not accessible.'

Interview Respondent

The MIMs Plus were described to be useful for technology procurements as it specifies the requirements that mechanisms should comply with. In doing so, it provides specifications without limiting the choice to just a small number of vendors. While their usefulness have been recognised, the MIMs Plus should work towards wider recognition by having clear use cases, testimonials and using an accessible language.

Exchange best practices

'We had help from the city of Tampere very much with the procurement process. They had done a similar procurement two years ago'.

Interview Respondent

Communities face similar challenges, and therefore, it is often useful to exchange experiences as local solutions can be applicable across administrations. This recommendation encourages local administrations, especially those responsible for technical solutions to seek platforms and occasions to learn about existing solutions.

Rethink ICT procurement legislation

'Build legal experience and capacity to deal with the EU dimension (state aid etc.)'

Living-in.EU Technical Working Group Workshop

This recommendation refers to the public procurement law as it challenges technology procurement processes. While this law may result in the optimal price of a technology it can also cause fragmentation of the ICT landscape due to the plethora of different providers.

7 Annex

7.1 Interview Guide

Go-Li.EU: Technical Specifications Mapping

Interview Guide

Many thanks for taking the time to review Go-Li.EU's request to participate in an expert interview. You were invited to partake in this data collection because of your experience in public procurement. The goal of this exercise is to generate an overview of the technical specifications used for public procurements in Europe. In doing so, we also study the gaps in the requirements of the public and the private industry.

Interview Questions:

Context	Could you elaborate on your experience in public procurement?
Data	Could you elaborate on the technical specifications used for data?
	Could you elaborate on the specificity of these specifications?
Infrastructure	Could you elaborate on the technical specifications used for infrastructure?
	Could you elaborate on the specificity of these specifications?
Quality of Service	Could you elaborate on the technical specifications used for quality of service ?
	Could you elaborate on the specificity of these specifications?

7.2 Consent Form

Interviewee consent form

Thank you for participating in the interview we conduct as part of the Go-li.EU initiative coordinated by [Eurocities](#). As part of this project we, [OASC](#), are conducting interviews to map European technical specifications for public procurements.

Data collection purposes

For the study, we interview different experts. We will record the interview solely for the purposes of being able to fully focus on the conversation and will not share the recording with anyone outside of the project. The interview results will be used:

- to generate a report for the initiative Go-li.EU,
- to map the European technical specifications landscape,
- for research about data and publications including presentations at conferences,
- to inspire further work on technical specifications for public procurement.

The report may be published on the [Living-in.EU](https://living-in.eu) website and shared with project stakeholders. Individual contributions of interview subjects will be anonymised.

Responsibility and control

OASC is responsible for this processing activity. Any questions can also be directed at task coordinator of this exercise at sophie@oascities.org

Access, rectification, and erasure

You have a right to access your data, rectify them, or have them erased. If you wish to do so, please contact the task coordinator of this exercise at sophie@oascities.org

Duration of the data collection

The information collected during this study will be kept for no longer than the duration of the initiative which ends October 1st, 2025.

Any other questions, remarks or complaints

I am your first point of contact (thimo@oascities.org). If you wish to file a complaint about how we handle your data, you can contact the Belgian Data Protection Authority at: *Gegevensbeschermingsautoriteit (GBA)*, www.gegevensbeschermingsautoriteit.be, *Drukpersstraat 35, 1000 Brussel +32 2 274 48 00*, contact@apd-gba.be

I agree to take part in the interview

I agree for the interview to be recorded

I agree to the use of my contributions for a public report of the Go-li.EU initiative.

Signed by (name) on (date)

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