

# ETSI GR CIM 049 V1.1.1 (2024-11)



## Context Information Management (CIM); Usage of geo-information

(<https://standards.iteh.ai>)

### Document Preview

[ETSI GR CIM 049 V1.1.1 \(2024-11\)](https://standards.iteh.ai/catalog/standards/etsi/acad8fac-acae-44d9-b532-67eb320bb1ee/etsi-gr-cim-049-v1-1-1-2024-11)

<https://standards.iteh.ai/catalog/standards/etsi/acad8fac-acae-44d9-b532-67eb320bb1ee/etsi-gr-cim-049-v1-1-1-2024-11>

#### *Disclaimer*

---

The present document has been produced and approved by the cross-cutting Context Information Management (CIM) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG. It does not necessarily represent the views of the entire ETSI membership.

---

**Reference**

DGR/CIM-0049

---

**Keywords**

API, IoT, NGSI-LD

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from the  
[ETSI Search & Browse Standards](#) application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed, this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our [Coordinated Vulnerability Disclosure \(CVD\)](#) program.

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.  
All rights reserved.

# Contents

|   |    |
|---|----|
| Intellectual Property Rights .....                                | 5  |
| Foreword.....   | 5  |
| Modal verbs terminology.....                                      | 5  |
| 1 Scope .....   | 6  |
| 2 References .....  | 6  |
| 2.1 Normative references .....                                    | 6  |
| 2.2 Informative references.....                                   | 6  |
| 3 Definition of terms, symbols and abbreviations.....             | 6  |
| 3.1 Terms.....  | 6  |
| 3.2 Symbols.....  | 7  |
| 3.3 Abbreviations .....   | 7  |
| 4 Problem Statement .....   | 7  |
| 5 Methodology .....   | 9  |
| 5.1 Information required.....                                     | 9  |
| 5.2 Information gathering process.....                            | 9  |
| 5.3 Interviews .....  | 9  |
| 6 Results of interviews - Use cases .....                         | 10 |
| 6.1 General .....   | 10 |
| 6.2 Real Estate and urban infrastructure.....                     | 10 |
| 6.2.1 Overview .....  | 10 |
| 6.2.2 The 10-minute city.....                                     | 11 |
| 6.2.3 Underground utilities networks.....                         | 11 |
| 6.3 Dealing with disasters .....                                  | 11 |
| 6.4 Mobility.....   | 12 |
| 6.5 Other use cases .....   | 12 |
| 7 Challenges related to geospatial data for cities .....          | 13 |
| 7.1 Challenge of defining regions of interest .....               | 13 |
| 7.2 The need for context to observations.....                     | 13 |
| 7.3 The need to work at different scales.....                     | 13 |
| 7.4 Batch integration and near real time integration.....         | 13 |
| 7.5 Local Digital Twins.....                                      | 14 |
| 7.6 The challenge of data models.....                             | 14 |
| 7.6.1 Complexity .....  | 14 |
| 7.6.2 The need of subject experts to develop the data models..... | 14 |
| 7.6.3 The need of a consistent approach.....                      | 15 |
| 7.7 Identifiers .....   | 15 |
| 7.8 Issues with software .....                                    | 15 |
| 7.8.1 GIS Software .....  | 15 |
| 7.8.2 Game engines.....   | 16 |
| 7.8.3 Mapping software .....                                      | 16 |
| 8 Examples of good practice .....                                 | 17 |
| 8.1 Introduction .....  | 17 |
| 8.2 Minimal Interoperability Mechanisms .....                     | 17 |
| 8.3 Civitas Connect .....   | 17 |
| 8.4 Valencia.....   | 19 |
| 8.5 Other cities and projects .....                               | 19 |
| 9 Overall priorities .....  | 20 |
| 9.1 Introduction .....  | 20 |
| 9.2 The use of NGSI, NGSI v2 and LD .....                         | 20 |
| 9.3 Aligning data sets.....                                       | 20 |
| 9.4 Domain Driven Design.....                                     | 20 |

|                 |   |           |
|-----------------|---|-----------|
| 9.5             | Addressing the issue of defining regions of interest..... | 21        |
| 9.6             | Minimal Interoperability Mechanisms .....                 | 21        |
| 10              | Conclusions .....   | 21        |
| <b>Annex A:</b> | <b>Interview Questions .....</b>                          | <b>22</b> |
| History .....   |   | 23        |

i T h S t a n d a r d s  
 ( h t t p s : / / s t a n d a r d s . i t  
 D o c u m e n t i e P w r

E T S I G V R 1 C I M ) ( 2 0 2 4 - 1

h t t p s : / / s t a n d a r d s . i t e h . a i / c a t a l o g m s - 1 0 a 4 n 9 1

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the [ETSI IPR online database](#).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G logo** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

## Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) cross-cutting Context Information Management (CIM).

---

## Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

---

## 1 Scope

The present document contains the key learning gained from 13 interviews with a variety of key city stakeholders.

---

## 2 References

### 2.1 Normative references

Normative references are not applicable in the present document.

### 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI GS CIM 050: "Context Information Management (CIM); Aligning with geo-information".
- [i.2] [The Smart City Strategy of the City of Brussel.](#)
- [i.3] [Local Digital Twins: Forging the Cities of Tomorrow.](#)
- [i.4] [A proof of concept to show the ingestion of data into a FROST-Server using the Orion Context Broker API.](#)
- [i.5] Recommendation ITU-T Y.4505: "Minimal Interoperability Mechanisms for smart and sustainable cities and communities".
- [i.6] Open Geospatial Consortium (OGC): "[Web Feature Service](#)".
- [i.7] Open Geospatial Consortium (OGC): "[OGC APIs - Features](#)".
- [i.8] [GeoJSON](#).
- [i.9] Open Geospatial Consortium (OGC): "[Geography Markup Language \(GML\)](#)".
- [i.10] [OGC GeoPackage](#).
- [i.11] Open Geospatial Consortium (OGC): "[CityGML](#)".
- [i.12] [ISO 16739-1:2024](#): "Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries - Part 1: Data schema".
- [i.13] [Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007](#) establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

---

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

Void

## 3.2 Symbols

Void

## 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

|         |   |
|---------|---|
| AI      | Artificial Intelligence                       |
| API     | Application Programming Interface             |
| BIM     | Building Information Modeling                 |
| CAD     | Computer Aided Design                         |
| DG      | Directorate General                           |
| DS4SSCC | Data Space for Smart Communities              |
| GIS     | Geographic Information System                 |
| GML     | Geography Markup Language                     |
| GS      | Group Specification                           |
| IEC     | International Electrotechnical Commission     |
| IFC     | Industry Foundation Classes                   |
| IoT     | Internet of Things                            |
| IT      | Information Technology                        |
| JRC     | Joint Research Center                         |
| JTC     | Joint Technical Committee                     |
| LD      | Linked Data                                   |
| LDT     | Local Digital Twin                            |
| MIM     | Minimal Interoperability Mechanism            |
| MIM     | Minimal Interoperable Mechanism               |
| NGSI    | Next Generation Service Interface             |
| NGSI-LD | Next Generation Service Interface Linked Data |
| OGC     | Open Geospatial Consortium                    |
| SAREF   | Smart Applications REference ontology         |
| STA     | SensorThings API                              |
| SyC     | Systems Committee                             |
| WFS     | Web Feature Service                           |

## 4 Problem Statement

The present document has been written to provide an accurate picture of how smart cities and territories are using geo-information at the moment, what standards they are using for what purposes and what experiences there are in using NGSI-LD as part of those use cases. The present document also covers the use of geo-information related to environmental issues more generally, as covered by the INSPIRE directive [i.13].

The aim is to be to highlight the key challenges of using NGSI-LD to link to data managed using such standards such as OGC WFS [i.6] and OGC API [i.7] as well as the INSPIRE directive's [i.13] requirements, or encoded using such standards as GeoJSON [i.8], GML [i.9], GeoPackage [i.10], CityGML [i.11] and IFC [i.12]. These challenges would then be addressed by ETSI GS CIM 050 [i.1]. The aim, along with the associated deliverable ETSI GS CIM 050 [i.1], is to enable ETSI to further develop the work on NGSI-LD to:

- specify how to make geodata accessible as Linked Data, how to share spatial (and spatio-temporal) data, and how to make them interoperable with, within, and between systems and territories;
- specify how to both establish and maintain the number of connections between NGSI-LD entities and their geographical 2D/3D representations.

The three families of standards considered; NGSI-LD, Geospatial standards developed by the Open Geospatial Consortium, and BIM and IFC standards developed by BuildingSmart International (see <https://www.buildingsmart.org>), are all used by cities although often by different departments within those cities.

All three sets of standards need to handle the same set of issues:

- Data about locations and movements.
- Data about urban infrastructure - buildings, roads, bridges.
- How to link different data sources together to provide insight.

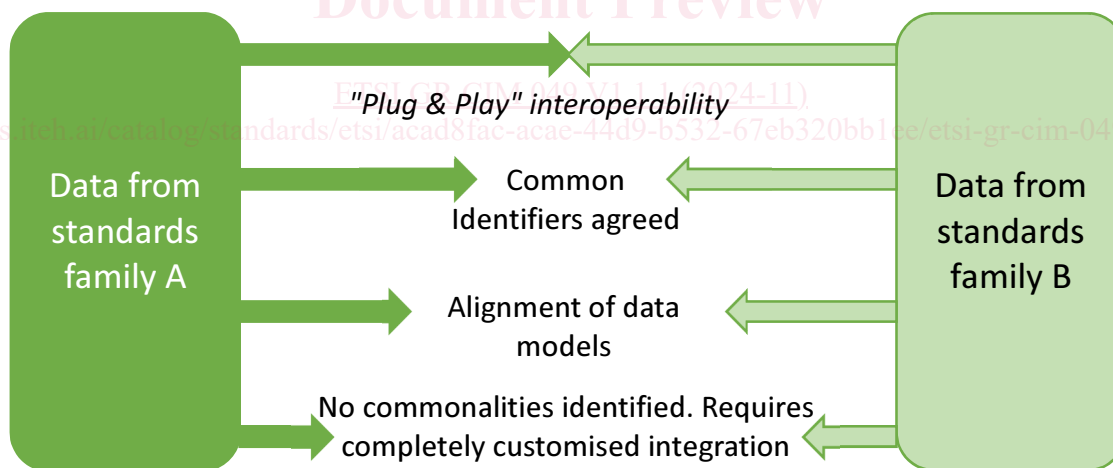
However, because of their different focus, they each have their own strengths and weaknesses. At a very high-level:

- NGSI-LD is particularly good at enabling IoT data to be linked with valuable context data to show its significance. It can handle geospatial and building data but only to a certain level.
- OGC standards allow geo-spatial data to be handled to a high degree of sophistication, but can only provide a certain degree of context and building related information.
- BIM/IFC standards provide a rich and detailed way of describing buildings and urban infrastructure, but struggle to indicate precise geographic location and wider context.

The interviews highlighted that smart cities and communities are increasingly recognizing that to tackle almost any urban issues, they need to be able access detailed sets of specific information about location, urban infrastructure and context taken from data collected using these different sets of standards.

They do not need all possible information - just the minimal but "good enough" sets of information relevant to guide them in tackling specific challenges. They are therefore trying to identify practical solutions and "work arounds" that will enable them to gather the information they need from data collected using the different standards. The present document identifies a number of these "work arounds" that cities are using. ETSI, along with OGC and BuildingSmart International, need to see how the standards they develop can be enhanced to support the use of these solutions.

There are many ways to improve ease of integration between different data structured according to different data standards. For instance, it is helpful if the different data sets use common data models for all the key entities, or at least ones that can easily be aligned. Similarly, the use of common identifiers will greatly add data integration. The use of these solutions can greatly enhance the ease of integration between the different types of data.



**Figure 1: Examples of solutions to improve data integration**

It is interesting that OGC have also recognized the need to find alignment with smart data models and linked data and the present document learns from their proof of concept. So, there is an opportunity to work at this from both sides.

The interviews indicated that the key issue is not one or two specific use cases where smart cities and communities are using geospatial standards, but rather that they are increasingly realizing that to tackle almost every challenge they face, they need to be able to bring together information from geospatial data and services and context data from NGSI v2 along with NGSI-LD and other formats using linked data.

## 5 Methodology

### 5.1 Information required

The work was aimed at using interviews to identify common use cases where smart cities and territories need to use geospatial data as a key part of the solution and specifically, any information about any role that NGSI might play in helping to link context information to the geospatial data.

In addition, the interviews were used to identify any challenges in linking NGSI with geospatial data and any solutions developed by those interviewed so that this could feed into the work of deliverable D4 within this project.

### 5.2 Information gathering process

The work commenced with informal interviews with the European Commission DG JRC team managing the INSPIRE initiative, Forum Virium Helsinki, Civitas-Connect and Porto Digital to gain a general overview of the key issues. Using these interviews, and internal discussions, a set of eleven questions was agreed to act as the basis for a further set of interviews, to ensure that all key issues were covered. The questions are provided in Annex A.

The interviews were transcribed using the help of an AI application and many of them were also recorded.

All the participants acknowledged the value of the work that ETSI has originated and are open to further interviews and questions, which will be a useful input to the work on deliverable ETSI GS CIM 050 [i.1].

### 5.3 Interviews

13 interviews were conducted, each lasting on average around one hour:

- European Commission DG JRC/INSPIRE on the general issues of cities and communities linking their geospatial data with other data.
- Overview of Swedish municipalities use of geospatial data by Tobbe Lahrin - a public sector geospatial expert since the 80 s and who has been working for the last few years on supporting Swedish municipalities around the use of IoT.
- Valencia that uses NGSI extensively and has done a lot of work on a platform that can provide two-way alignment with geospatial data.
- Porto digital (2 x) the innovation agency of the city of Porto, that is actively exploring how to integrate their NGSI-data with their GIS data.
- Civitas-Connect a German not for profit made up of 7 cities and regions and 6 municipal companies, all exclusively in the public sector that is developing a core data sharing platform on behalf of the members, which specifically aims to address aligning NGSI and OGC standards.
- Rennes - a French city that is investigating the potential role of NGSI in its data platform, with the link with geospatial data as one of the key issues.
- Forum Virium Helsinki - a city with a strong geospatial background, that is looking at how to link geospatial with other types of data to provide added insights, specifically around the use of local digital twins.
- Riga.
- Eindhoven.
- City of Brussels.
- Catalonia/Norway consortium preparing proposal for a bid for DS4SSCC pilot focusing on linking different types of data and with a strong FIWARE® and OGC background.

- A Consortium that has won a proposal starting in September 2024 3DXVERSE on developing a platform to link LDTs.

These interviews provided a great deal of information about key use cases related to geospatial data and some helpful information about the challenges that this will involve.

---

## 6 Results of interviews - Use cases

### 6.1 General

Based on recent research commissioned by the European Commission DG JRC, the team interviewed confirmed that all cities heavily use geospatial data for many issues. This is because cities are required to maintain much of this information by government regulations and also because they need it to manage all the assets that they own and tackle key issues such as managing traffic and the environment, for which geospatial data is vital.

However, the research showed that **this city data tends to be siloed off** and not readily available for re-use. The interviews conducted for the present document highlighted the fact that in many cities the Geospatial department **tends to manage its data separately from the data collected by other departments**.

This provides the opportunity for significant gains from leveraging geospatial data more effectively and linking it with other data to help the city tackle the key issues it faces. In this clause 6, some of the main use cases within smart cities and communities are covered for linking geospatial data with other data to gain greater insight.

The interviews made it clear that cities and communities need to use geospatial data alongside other data in order to address a number of different use cases and some of the most important of these are covered in this clause.

In looking at these use cases, it is important not just to focus on the technical issues of interoperability, but also to look more widely at how data can support the procurement of solutions and the wider business case for the investment needed in gathering and using the data. It is not enough to develop solutions that work if they cannot be implemented because of the lack of a clear business case.

So, when looking for solutions, it is useful to look at each use case, not only from the perspective of what data is needed to make it work, but also to identify what data is needed to demonstrate value for money. Most of the data needed will be common, but there is likely to be some additional requirements, the fulfilment of which would help to enrich the business case for using geospatial and other data to tackle that use case.

For instance, it is important to show that the solution is described in a way that demonstrates how it opens up the data to be used in other ways by providing some hooks that will allow solutions to other use cases to be built on more easily in the future.

### 6.2 Real Estate and urban infrastructure

#### 6.2.1 Overview

In looking at use cases, the obvious place to start is real estate within the city - the buildings and their inhabitants, the roads, along with all of the urban infrastructure - as this is the first reason why cities needed to collect geospatial data.

The city needs to be able to identify where all the buildings in the city are, who owns them and who uses them. It needs to be able to identify the boundaries of parcels of land and who has rights over the use of that land.

There are many specific use cases. For instance, when procuring work to resurface a road, it is important to know the surface area of that road so as to quantify how much tarmac will be needed to cover it, and to be able to define exactly the precise length of road that needs to be resurfaced. Defining the surface area of a road is also important when it comes to putting salt on the roads during icy weather, or using snow ploughs to clear the roads, or even cleaning up roads after a major storm from mud and debris.

Then there are all the requirements of city planning to make long term plans for the city and decide where new housing can be built, where industry should be located, and where there should be commercial offices.