



ASSESSMENT SUMMARY v1.0.0

Context Information Management (CIM); NGSI-LD API¹

European Telecommunications Standards Institute (ETSI)²

¹ CIM NGSI-LD API: https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.07.01_60/gs_CIM009v010701p.pdf

² ETSI: <https://www.etsi.org/>

Change Control

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TABLE OF CONTENT

- 1. INTRODUCTION..... 4**
- 2. ASSESSMENT SUMMARY..... 4**
 - 2.1. Interoperability Principles4
 - 2.2. Interoperability Layers.....7
- 3. ASSESSMENT RESULTS 9**

1. INTRODUCTION

The present document is a summary of the assessment of **CIM NGSI-LD API** carried out by CAMSS using the CAMSS EIF assessment scenario. The purpose of this scenario is assessing the compliance of a standard or specification with the European Interoperability Framework (EIF)³.

2. ASSESSMENT SUMMARY

CIM NGSI-LD API allows users to provide, consume and subscribe to context information in multiple scenarios and involving multiple stakeholders. Context information is modelled as attributes (properties and relationships) of context entities, also referred to as "digital twins", representing real-world assets. It enables close to real-time access to information coming from many different sources (not only IoT data sources).

ETSI is a European Standards Organization (ESO). They are the recognized regional standards body dealing with telecommunications, broadcasting and other electronic communications networks and services. They have a special role in Europe. This includes supporting European regulations and legislation through the creation of Harmonised European Standards. Only standards developed by the three ESOs (CEN, CENELEC and ETSI) are recognized as European Standards (ENs).

2.1 Interoperability Principles

Interoperability principles are fundamental behavioural aspects that drive interoperability actions. They are relevant to the process of establishing interoperable European public services. They describe the context in which European public services are designed and implemented. The specification specifically addresses interoperability in cloud computing, which can be extremely useful in eGovernment by enhancing data portability, increased efficiency, and integrity.

The specification does not support the principles setting context for EU actions on interoperability:

- **Subsidiarity and proportionality**

CIM NGSI-LD API is not included within the catalogue of any Member State.

The specification fully supports the principles setting context for EU actions on interoperability:

- **Openness**

Annex E of CIM NGSI-LD AP contains an RDF-compatible specification of NGSI-LD meta-model, which facilitates the publication of data on the web. This Technical Specification (TS) has been produced by ETSI Technical Committee Context Information Management (CIM)⁴. The participation in the technical group is reserved to ETSI members, who require registration, fees, and membership approval. ETSI typically follows a policy of providing fair, reasonable, and non-discriminatory (FRAND) licensing for its standards.

³ European Interoperability Framework (EIF): https://ec.europa.eu/isa2/eif_en

⁴ ETSI ISG CIM: <https://www.etsi.org/committee/cim>

CIM NGSI-LD AP is currently in its 1.7.1 version thus, major releases have been published. In addition, public documentation inside the specification has been published about its supporting process, specifically related to change history and issues regarding every version. This specification is being directly used to create innovative solutions. For instance, it is included in Open & Agile Smart Cities & Communities (OASC)⁵, an international network of cities and communities that partners with local administrations of all sizes and all over the world to assist them in their journey towards digital transformation.

- **Transparency**

While this CIM NGSI-LD API's scope is not explicitly directed towards visibility of administrative procedures, rules data, and services, the new specification can improve it by defining a simple way to send or request data, using a serialization format (JSON-LD) which is very familiar to many developers so that rapid adoption is facilitated. This specification enables close to real-time (right-time) access to context/digital twin information coming from many different sources (not only IoT data sources), thus scoping comprehensibly administrative procedures, rules data, and services. Finally, CIM NGSI-LD API actively promotes and supports visibility as it defines how such an API enables applications to perform updates on context and register context providers which can be queried to get updates.

- **Reusability**

The NGSI-LD Information Model prescribes the structure of context information that shall be supported by an NGSI-LD system. The NGSI-LD Information Model is defined at two levels: the foundation classes which correspond to the Core Meta-model and the Cross-Domain Ontology. The latter is a set of generic, transversal classes which are aimed at avoiding conflicting or redundant definitions of the same classes in each of the domain-specific ontologies.

- **Technological neutrality and data portability**

This specification is based on linked data principles and uses JSON-LD as its serialization format. JSON-LD is a widely supported format in web development, contributing to the platform and technology-agnostic nature of CIM NGSI-LD API. Section 4.3.5 of the specification focuses on API Structure and Implementation Options, which highlights how it can be implemented incrementally or separately. In addition, NGSI-LD API can be customised and extended to some extent based on the specific needs of a particular application or system like defining their own data models for entities, relationships, and properties within the framework of NGSI-LD.

CIM NGSI-LD API can contribute to improving data portability as by defining a standardised way to represent entities, their properties, and relationships. Moreover, the use of JSON-LD's @context enables the definition of fully qualified names (URIs) for terms used in data payloads. Consequently, this standardisation promotes interoperability by ensuring that systems using the API can exchange data seamlessly.

⁵ ETSI Releases Full-Feature Specification to Support Smart Cities & Communities: <https://oascities.org/etsi-release-full-feature-specification-to-support-smart-cities-communities/>

The specification partially supports the principles related to generic user needs and expectations:

- **User-centricity**

While CIM NGSI-LD API does not mention any specific action to support the reuse of relevant information when needed, the principle of reuse and alignment of concepts and relationships are embedded in CIM NGSI-LD API, Linked Data principles can be applied to create a web of interconnected and reusable data, which aligns with the goal of the Once-Only Principle to avoid redundant data collection.

- **Inclusion and accessibility**

The purpose of CIM NGSI-LD API is not related to e-accessibility. Therefore, this criterion is considered not applicable to this specification.

- **Privacy**

of the supporting documents of CIM NGSI-LD API is ETSI GR CIM 007⁶, which identifies the security and privacy aspects that are relevant. In this case, the specification is aligned with the General Data Protection Regulation (Regulation (EU) 2016/679, abbreviated GDPR)⁷. Furthermore, section 6.4 of the specification explains that in many instances data confidentiality is afforded by the application of encryption to content, although techniques such as path segregation (e.g. VPNs) and the use of secure enclaves in data processing are other measures that can be applied to give assurance of data confidentiality.

- **Security**

The standardised terms and concepts within CIM NGSI-LD API can facilitate clearer communication and understanding between systems, which is beneficial for secure data exchange protocols. The use of secure enclaves is mentioned when talking about data processing and mechanisms for giving proof of authentication are described in ETSI TS 102 165-2⁸ and ETSI TR 103 719⁹. Furthermore, integrity is a key characteristic of non-repudiation services and access to data may be restricted by requestor identity, by requestor location etc.

- **Multilingualism**

Since internationalization is not core to context information management, any direct support within NGSI-LD systems is limited. Annex G of the specification proposes a series of best practices for maintaining, querying and displaying interoperable internationalized data. For instance, there are specific provisions to associate an Entity or a Property with a Natural Language.

⁶ GR CIM 007: https://www.etsi.org/deliver/etsi_gr/CIM/001_099/007/01.01.02_60/gr_cim007v010102p.pdf

⁷ GDPR: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R0679>

⁸ ETSI TS 102 165-2:

https://www.etsi.org/deliver/etsi_ts/102100_102199/10216502/04.02.01_60/ts_10216502v040201p.pdf

⁹ ETSI TR 103 719:

https://www.etsi.org/deliver/etsi_tr/103700_103799/103719/01.01.01_60/tr_103719v010101p.pdf

The specification supports the foundation principles for cooperation among public administrations:

- **Administrative Simplification**

CIM NGSI-LD API provides a simple way to send or request data with its context transmitted together, which represents an efficient way of exchanging and communicating data on different platforms, improving processes related to the delivery of public services is possible. In addition, the specification's API enables applications to perform updates on context, register context providers which can be queried to get updates on context and subscribe to receive notifications of context changes, all of which could improve digital service delivery channels.

- **Preservation of information**

CIM NGSI-LD API is not related to enabling the long-term preservation of data (electronic records included). Therefore, this criterion is considered not applicable to this specification.

- **Assessment of effectiveness and efficiency**

The effectiveness and efficiency of CIM NGSI-LD API is often evaluated through various means, including practical implementation and scalability. For instance, a 2021-paper¹⁰ by ETSI is intended to explain how to use the NGSI-LD API in a more “hands-on” practical way, especially for the initial use cases considered location, which demonstrates the effectiveness of CIM NGSI-LD API. Another 2021-paper¹¹ focuses on enhancing the semantic capabilities of the oneM2M based on the ones defined by CIM NGSI-LD API, among others.

2.2 Interoperability Layers

The interoperability model which is applicable to all digital public services includes:

- Four layers of interoperability: legal, organisational, semantic, and technical.
- A cross-cutting component of the four layers “integrated public service governance”.
- A background layer, “interoperability governance”.

The Specification supports the implementation of digital public services complying with the EIF interoperability model:

- **Interoperability Governance**

At the time of elaborating this assessment, this specification is included in the "Data Space Connector Consumer" and "Data Space Connector Provider" ABB from the "Technical-Application" View of the current European Library Of Specifications (ELIS).

¹⁰ Guidelines for Modelling with NGSI-LD:

https://www.researchgate.net/profile/Gilles-Privat/publication/349928709_Guidelines_for_Modelling_with_NGSI-LD_ETSI_White_Paper/links/6047dca2299bf1e07869576b/Guidelines-for-Modelling-with-NGSI-LD-ETSI-White-Paper.pdf

¹¹ ETSI SmartM2M Technical Report 103716: <https://inria.hal.science/hal-03261059/document>

Most ETSI test specifications are developed according to ISO/IEC 9646¹² as this standard provides an excellent basis to produce high-quality test frameworks and specifications. CIM NGSI-LD API is relevant in both national and European scenarios. The Open Data initiative of the Spanish government mentions the use of this specification and the extended Smart Data Models for the adoption of the information model defined by the IDS architecture. This is crucial for the technical convergence of the Data Spaces Business Alliance (DSBA)¹³.

Also, it is included in the extension of FIWARE to support Linked Data (LD)¹⁴ according to One Network for Europe, a project funded through the EU's eighth Framework Programme Horizon 2020. Furthermore, CIM NGSI-LD API is included in EU Observatory for ICT Standardisation¹⁵ and the Data Space Support Center (DSSC) standards catalogue¹⁶.

- **Legal interoperability**

ETSI is a European standards development organisation, and as such, all the specifications developed within the organisation are available and can be accessed through its website repository. Therefore, CIM NGSI-LD API is a European Standard.

- **Organisational interoperability**

While the specification itself is not explicitly intended for modelling business processes, it can facilitate its designing process as it models "real world entities", its properties and relationships in a standardised way. On the other hand, CIM NGSI-LD API can be used to technically maintain a single consistent API for Context Information Management, particularly for Smart City applications and government services, which can help when drafting agreements related to that.

- **Semantic Interoperability**

- CIM NGSI-LD API is maintained by the European Telecommunications Standards Institute (ETSI), a European Standards Organization (ESO) that is recognised as the regional standards body dealing with telecommunications, broadcasting and other electronic communications networks and services.

¹² ISO/IEC 9646-1:1994: <https://www.iso.org/standard/17473.html>

¹³ Technical Convergence DSBA: <https://datos.gob.es/en/blog/technical-convergence-dsba>

¹⁴ Extended Interoperability and Management with FIWARE D6.3:

https://www.onenet-project.eu/wp-content/uploads/2023/09/OneNet_D6.3_v1.0.pdf

¹⁵ CIM NGSI-LD API: <https://standict.eu/standards-repository/context-information-management-cim-ngsi-ld-api>

¹⁶ DSSC Data Interoperability:

<https://dssc.eu/space/SE1/185794608/Data+Interoperability+standards+and+technologies+landscape>

3. ASSESSMENT RESULTS

This section presents an overview of the results of the CAMSS assessments for the **CIM NGS-LD API**. The CAMSS “Strength” indicator measures the reliability of the assessment by calculating the number of answered (applicable) criteria. On the other hand, the number of favourable answers and the number of unfavourable ones is used to calculate the “Automated Score” per category and an “Overall Score”.

Category	Automated Score	Assessment Strength	Compliance Level
Principles setting the context for EU actions on interoperability	20/100 (20%)	100%	Ad-hoc
Core interoperability principles	1640/1700 (96%)	100%	Seamless
Principles related to generic user needs and expectations	1000/1200 (83%)	75%	Seamless
Foundation principles for cooperation among public administrations	500/500 (100%)	80%	Seamless
Interoperability layers*	800/1000 (80%)	100%	Seamless
Overall Score	3560/4100 (87%) ¹⁷	91%	

**The technical interoperability layer is covered by the criteria corresponding to the core interoperability principle "Openness".*

With an 91% of assessment strength, this assessment can be considered representative of the specification compliance with the EIF principles and recommendations.

The Overall Automated Score of 87% (3560/4100) demonstrates that the specification supports the European Interoperability Framework in the domains where it applies.

¹⁷ See the “results interpretation” section of the CAMSS Assessment EIF Scenario Quick User Guide: <https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/solution/camss-assessment-eif-scenario/results-visualisation-and-interpretation>