



ASSESSMENT SUMMARY v1.0.0

Linked Data Event Streams (LDES)¹

European Commission (SEMIC)²

¹ LDES: <https://joinup.ec.europa.eu/collection/semic-support-centre/linked-data-event-streams-ldes>

² European Commission (SEMIC): <https://joinup.ec.europa.eu/collection/semic-support-centre>

Change Control

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1. INTRODUCTION

The present document is a summary of the assessment of **LDES** 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

Linked Data Event Streams (LDES) is a new data publishing approach which allows you to publish any dataset as a collection of immutable objects. The focus of an LDES is to allow clients to replicate the history of a dataset and efficiently synchronise with its latest changes. Linked Data Event Streams could be used to maintain and open up reference datasets to foster interoperability by advocating the reuse of the identifiers for which they are the authoritative source. By making data accessible via one URI endpoint, LDES makes it easy to retrieve data which is published as a uniform linked data standard.

LDES is developed by the Semantic Interoperability Community (SEMIC), which develops solutions to help European public administrations perform seamless and meaningful cross-border and cross-domain data exchanges.

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**

LDES is not included in any national catalogue of recommended specifications whose Member State NIF has a high performance on interoperability according to NIFO factsheets.

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

- **Openness**

A Linked Data Event Stream (LDES) is a new data publishing approach which allows you to publish any dataset as a collection of immutable objects in RDF. This specification is developed by the SEMIC, who has established Working Groups for those who wish to participate in semantic solutions. SEMIC develops under the ISA2 ⁴ Programme, whose solutions are under ISA Open Metadata Licence which is a perpetual, royalty-free and non-exclusive license.

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

⁴ ISA2: https://ec.europa.eu/isa2/home_en/

The specification had one major release published on the 6th of September of 2023. At the same time, the specification has a GitHub⁵ where change and release management is published. Linked Data Event Streams offers a service to help e-Government professionals share their experience with each other, so it fosters the creation of innovative solutions. Finally, the SEMIC Support Center is responsible for the development of the specification. They oversee its maintenance, implementation pilots, knowledge sharing and, strategy and roadmap.

- **Transparency**

By allowing the publication of data as "event streams", public administrations can share real-time updates about different processes and improve the visibility of their tasks. Furthermore, LDES aims to allow clients to replicate the history of a dataset and efficiently synchronise with its latest changes, improving the public administration's comprehensibility. Finally, thanks to this specification the exposure of interfaces to access the public administration's services would improve as it allows multiple third parties to stay in sync with the latest version of the data source in a resource and cost-effective manner.

- **Reusability**

The underlying principles and technologies of LDES are designed to be domain-agnostic. In other words, the concepts and standards provided by LDES can be applied to a wide range of domains. The key idea is to represent events and their relationships in a standardized, machine-readable format using Linked Data principles.

- **Technological neutrality and data portability**

Linked Data Event Streams (LDES) itself is a conceptual framework and a set of principles for representing and publishing real-time event data using Linked Data on the web. Thus, it is platform and technology-agnostic. This specification can be used for basic events' publication or focus on adopting LDES alongside other existing data exchange mechanisms, creating a hybrid model that embraces the strengths of each approach.

One of the great advantages of using LDES is its flexibility. LDES can be easily customised and extended to different contexts and applications. Section 4 of the specification talks about multiple best practices on how to annotate that a newly published collection derived from an LDES. The specification provides a robust framework to ensure that data can be easily shared, understood and used across systems. Therefore, it could contribute to enabling data portability.

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

⁵ LDES GitHub: <https://github.com/SEMICeu/LinkedDataEventStreams>

- **User-centricity**
The application of the once-only principle in all EU Member States public administrations aims at reducing the administrative burden. This specification provides a standardised approach for representing and publishing real-time event data on the web using Linked Data principles, impacting positively the development of eGovernment.
- **Inclusion and accessibility**
The purpose of LDES is not related to e-accessibility. Therefore, this criterion is considered not applicable to this specification.
- **Privacy**
LDES is not related to privacy matters in any way. Therefore, this criterion is considered not applicable to this specification.
- **Security**
Even though the purpose of this specification is not directly related to the protection against unauthorised changes, LDES inherently helps maintain data integrity through the immutability of events, a principle that allows keeping track of data alterations.
- **Multilingualism**
LDES itself is a specification for representing and publishing real-time event data on the web using Linked Data principles. While the specification provides a framework for structuring event data, the multilingual support may be influenced by how the data within the events is represented and linked.

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

- **Administrative Simplification**
The purpose of the specification is to facilitate the exchange of structured event data. By allowing to make the data available to other persons or organisations, this specification reduces the administrative burden and enables digital service delivery channels.
- **Preservation of information**
The specification explicitly addresses and enables long-term preservation as it allows clients to replicate the history of a dataset and efficiently synchronise with its latest changes.

- **Assessment of effectiveness and efficiency**

The effectiveness and efficiency of LDES is often evaluated through various means, including practical implementations and pilot projects. A 2021-paper⁶ introduces the concept of a Linked Data Event Stream (LDES) for publishing base registries, which demonstrates the effectiveness of LDES. On the other hand, a 2023-doctoral dissertation⁷ presents LDES as an open data interface for live data consumption in integrated services, which highlights the specification's efficiency.

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 current European Library Of Specifications (ELIS), specifically the Linked Data Event Stream ABB in the "Semantic View" layer and the Immutable Database Manager ABB in the "Technical-Infrastructure View" layer.

The specification has a section dedicated to conformance. Conformance requirements are expressed with a combination of descriptive assertions and RFC 2119⁸ terminology. Furthermore, Interoperability Test Bed (ITB)⁹ can also be used to test LDES.

LDES has been recommended by the Spanish government through their open data initiative webpage¹⁰. The government's blog explains how LDES can help overcoming data publishing challenges. Even so, LDES is not included in any Member States' catalogues of recommended specifications. Nevertheless, the specification is included in the SEMIC community in Joinup.

⁶ Publishing Base Registries as Linked Data Event Streams: https://link.springer.com/chapter/10.1007/978-3-030-74296-6_3

⁷ Linked Data Event Streams as an Open Data Interface for Live Data Consumption in Integrated Services: <https://imec-publications.be/bitstream/handle/20.500.12860/41413/phdfinal-brechtvandevyvere.pdf>

⁸ RFC 2119: <https://datatracker.ietf.org/doc/html/rfc2119>

⁹ ITB LDES: <https://joinup.ec.europa.eu/collection/interoperability-test-bed-repository/solution/interoperability-test-bed/news/itb-support-digital-flanders>

¹⁰ Overcoming Data Publishing Challenges with Linked Data Event Streams (LDES): <https://datos.gob.es/en/blog/overcoming-data-publishing-challenges-linked-data-event-streams-ldes>

- **Legal interoperability**

LDES is a European Standard as it was developed and recognized by the European standards organisation; it is also maintained by the EU community.

- **Organisational interoperability**

Linked Data Event Streams (LDES) primarily focuses on representing and publishing real-time event data on the web using Linked Data principles. Therefore, it is not designed explicitly for modelling business processes. In contrast, LDES can contribute to organisational interoperability agreements by providing standardised representation, common vocabularies, semantic interoperability, real-time collaboration, etc.

- **Semantic Interoperability**

Like all SEMIC services, SEMIC is the responsible for the maintenance and growth of the LDES development, as well as the community around it. In addition, SEMIC has launched a GitHub¹¹ where contributions and discussions can be made freely.

¹¹ LDES GitHub: <https://github.com/SEMICeu/LinkedDataEventStreams>

3. ASSESSMENT RESULTS

This section presents an overview of the results of the CAMSS assessments for the **LDES**. 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	1620/1700 (83%)	100%	Seamless
Principles related to generic user needs and expectations	1060/1200 (83%)	33%	Seamless
Foundation principles for cooperation among public administrations	500/500 (100%)	100%	Seamless
Interoperability layers*	820/1000 (82%)	100%	Seamless
Overall Score	3220/3700 (87%) ¹²	82%	

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

With an 82% 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% (3220/3700) demonstrates that the specification supports the European Interoperability Framework in the domains where it applies.

¹² 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>