

ONE Record: One Step Closer to Digital Cargo with Ontologies and Linked Data

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Abstract. Each air cargo shipment requires around 30 paper documents on average as it makes its way from shipper to consignee, via the freight forwarder, trucking company, airline, ground handler and customs authorities. ONE Record is an open standard for data sharing that defines a common data model that is exchanged via a standardized and secured API. It enables an end-to-end digital logistics and transport supply chain where data is easily and transparently exchanged in a digital ecosystem of air cargo stakeholders, communities and data platforms. The ONE Record Data Model, API and Security specifications provide the air cargo industry with a common language and standard data structure defined in an ontology, as well as secured interfaces for data exchange that are based on Linked Data principles. Currently, the number of companies implementing pilots based on ONE Record is close to 50 and keeps on increasing. One important aim of the pilots is to connect the supply chain stakeholders together to the extent of creating a global Internet of Logistics (IoL).

Keywords: Cargo, Ontology, Digital Twin, Linked Data, Internet of Logistics

Context. Air cargo transport is a complex and siloed industry. Its data exchange is mostly based on sequential information flow, meaning that each party sends the information to the next one in the supply chain. There is still a huge amount of paper and manual handling, both of which limit transparency and visibility of shipments and create an error-prone environment. Another consequence of paper being used throughout all the processes is duplication of information and therefore knowing the true source becomes difficult. To address this challenge, the ONE Record standard [1] explores the use of the Semantic Web from the air cargo ecosystem perspective and it proposes the use of concepts such as Linked Data and ontologies in order to achieve an end-to-end digital logistics and transport chain.¹

ONE Record Data Model, Digital Twin of the Cargo Industry. Air cargo is about physically moving goods. It includes physical assets such as the goods being transported or the means of transportation themselves. With this in mind, the data model reflects the physical world as much as possible using the digital twin concept. At this

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stage, we have developed an ontology written in Turtle syntax containing classes and properties that capture the domain of air cargo [2]. IATA participates in several multimodal data sharing projects, such as EU FEDeRATED² and the aim is to extend the scope of ONE Record to interact with different transport modes like maritime, road, rail or inline waterways. The goal is to achieve a federated network of platforms for data sharing in the freight transport and logistics domain at EU level, while providing interoperability and harmonisation between individual platforms.

API & Security Specifications. ONE Record defines API specifications for allowing airlines and their partners to connect their systems directly using web technologies that consume and produce JSON-LD format. The ONE Record API supports features like Publish & Subscribe, JSON-LD PATCH³, versioning – based on the Memento Protocol⁴ – and Web Access Control⁵. ONE Record Security specifies an industry-wide and federated trust network to manage identification and authentication of data sharing systems and ensures data privacy and confidentiality for all parties, based on the concepts of mutual TLS between servers and OAuth2 for users and other entities.

Engaging with the Cargo Community through ONE Record Pilots. The ONE Record pilot community builds applications and systems to evaluate feasibility, duration, cost, and improve upon the study design of the standard. ONE Record started in 2019 with 6 pilots around the world and 26 companies. Currently there are 7 ONE Record pilots, working on 10 use cases, and the number of companies involved is close to 50 and increasing as members join existing pilots.

Conclusion. The use of ontologies and Linked Data in air cargo facilitates data discovery by 3rd party applications and logistics networks, including multimodal transport. What the logistics ecosystem needs – and what Linked Data can provide – is a universal solution for linking disassociated freight content into a larger cohesive Internet of Logistics.

The ONE Record standard opens the way to a new digital era for logistics and the transport chain which is essential in a time of digital globalization. The increased use of Semantic Web concepts across different industries facilitates its adoption.

References

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² FEDeRATED Homepage, <http://www.federatedplatforms.eu/>.

³ JSON-LD PATCH GitHub, <https://github.com/digibib/ls.ext/wiki/JSON-LD-PATCH/>.

⁴ Memento Project Homepage, <http://mementoweb.org/about/>.

⁵ Web Access Control Homepage, <https://www.w3.org/wiki/WebAccessControl>.