INFLUENCE OF API INTERFACES ON DATA EXCHANGE AND INFORMATION SHARING IN THE TRANSPORT AND LOGISTICS SECTOR

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Abstract

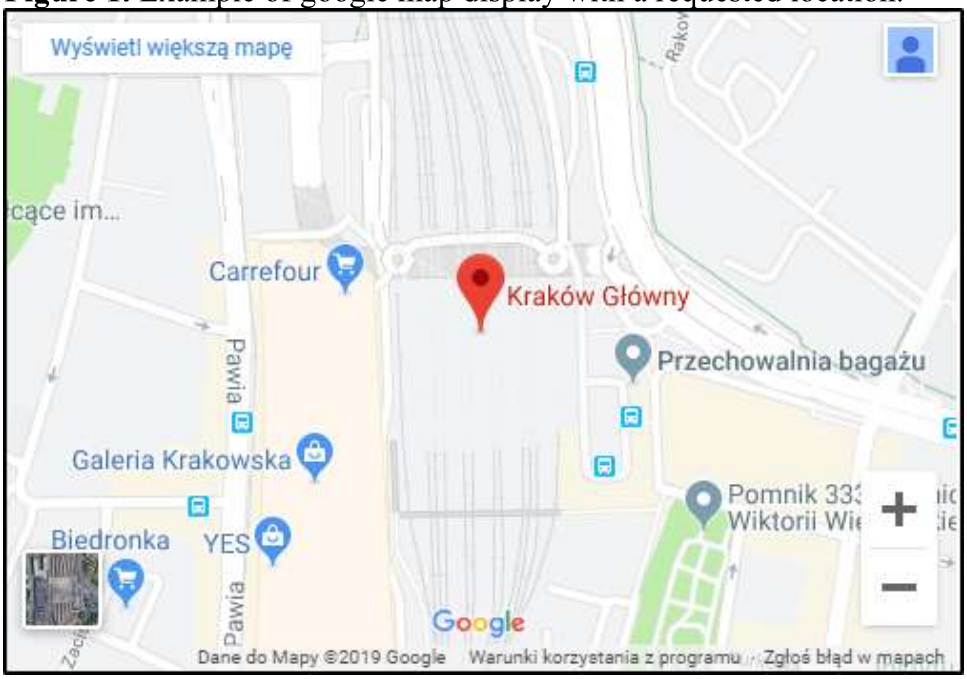
The article is based on the research on API interfaces used by logistics service providers and logistics integration platforms. The article shows what API interfaces are in use, compares API vs EDI, what business transactions are supported by API interfaces and what are the reasons of why API is used. The article considers a very important topic of standardization for API and shows the way how these standards for API can be achieved with a detailed roadmap.

Key words: API, EDI, transport, logistics, standardization, semantic data model

1. API INTRODUCTION

API (Application Programming Interface) can be described as a set of solutions which allows two computer systems to exchange information. Such interface shares the access points which enables functions or data to be used by external applications. A good example of API is to display a google map on the school or restaurant website. To display the below map it is enough to send a request to google API: https://www.google.com/maps/embed/v1/place?q=place_id:ChIJ0RhONcBEFkcRv4pHdrW2a7Q&key=1234

Figure 1. Example of google map display with a requested location.+



These requests might be more complicated and for those API data structures are used like JSON or XML. In general, there are two types of API :

- WEBAPI where http protocol is used which is not related to any operation system or programme language,
- Native API – programming interfaces uses code libraries and these are not used for integrations.

This research is just about WEBAPI. There are also two kinds of WEBAPI :

SOAP (Simple Object Access Protocol) well-defined interfaces having always its detailed description in a shape of WSDL, which contains all methods and data structures. WSDL helps external application for generating automated code for accessing this API. From the other hand, it requires quite a big code around this interface. So it is not easy for quick testing or simple solutions. SOAP is more formal and standardized what means we have to fit those standards but thanks to this we are getting tools which automate our job.

REST (representational state transfer) is built with completely different assumptions. Here we have URL addresses, which are identifiers. The request is being to this URL address which can have a format of JSON, XML, text or even binary file. What will happen depends on the method which is called (there are 7) like GET, DELETE etc. It is nice for quick testing and not complicated implementations or where the format of the request is not so important. It is not complicated when working with data like adding, retrieving, modifying or deleting records. From my point of view, this API is less formal and implementation can be very different.

2. RESEARCH OBJECTIVES AND METHODOLOGY

The Research has been made under the GS1 Poland standardization body for Identifiers and electronic messages. In GS1 Global Organization strategy API is defined as the following task: Add API standard components aligned with a data model. To observations has led us to suspect that API is a completely non-standardized piece of electronic communications in sense of data structures, is being developed by companies for individual needs without rules for harmonization of syntaxes and semantic.

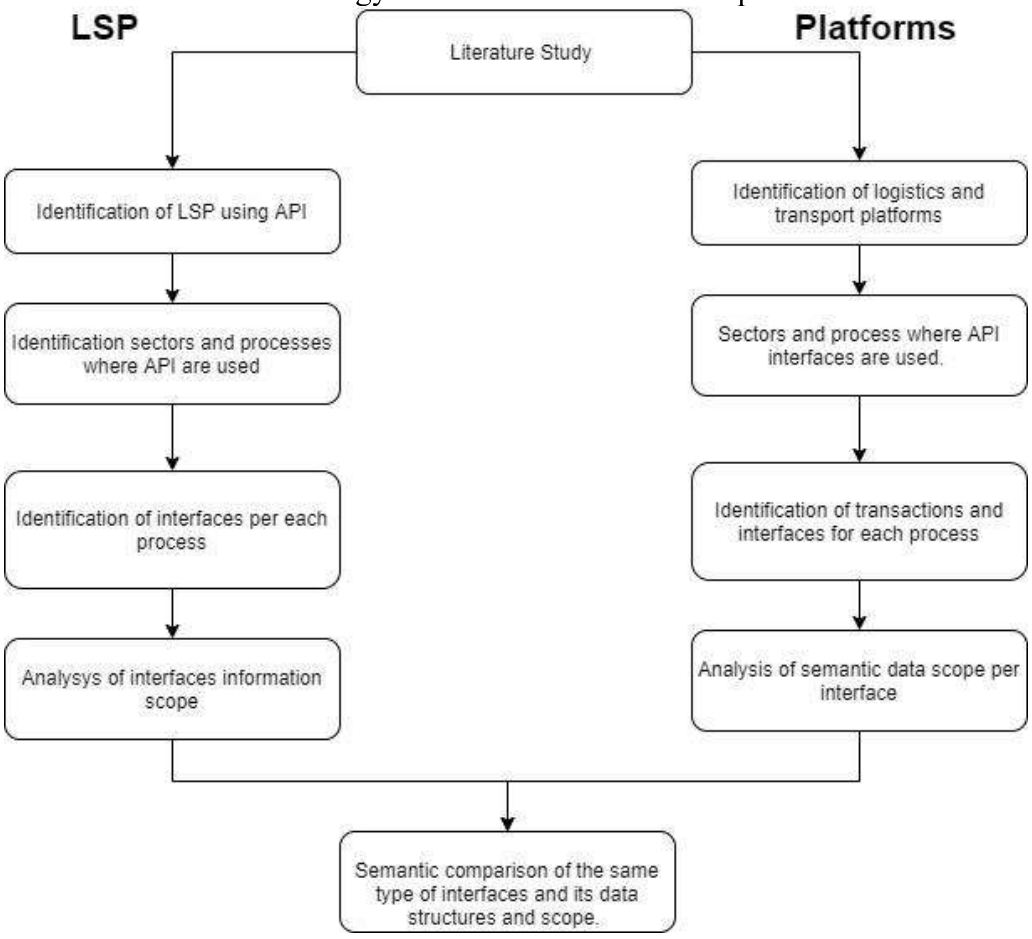
The main objective of this research was to identify API[1] interfaces used currently in the transport and logistics sector among logistics service providers and transport - logistics platforms[2] . Each interface has its structure of input and output data, those structures allow to compare them and in further work will be a basis for harmonizing data structures for API in the transport and logistics sector. One of the most important aspects of this research is to identify interfaces of the same type e.g. Sending transport order and compare the data among different LSP and platforms.

2.1. Research methodology

The research has been made among logistics service providers and logistics transportation and integration platforms which are active on the Polish market. However, most of are active in European and global scale. The research contained the following elements from the identification of LSP or platforms to the semantic comparison of data for the same type of interfaces. The below diagram shows detail research steps:

[1] Platforms - In this article platforms are defined as computer systems accessible via internet web browsers and serving commercial logistics services like finding transportation, carriers or integrating logistics players with its customers.

Figure 2. Research methodology for identification and comparison of API interfaces



The research in most of the cases has been made based on documentation provided by LSP or companies who maintain logistics and transportation platforms. The documentation mostly contained the technical description of interfaces, API specification with examples and processes descriptions. For both cases LSP and platforms it was important to identify interfaces which are responsible for the same type of business transaction like e.g. Provide transport order status. The next step after the identification of those interfaces was to compare the semantic aspect of these interfaces.

LSP which were taken into account for this research: Raben Group, Dachser, CEVA Logistics, DB Schenker, DHL, UPS. Used platforms were: Transportation Marketplaces (Trans.eu, Timocom), Parcel Carriers integration (Furgonetka, Apaczka), Logistics service integration platforms (Logintegra, Transporeon), e-Commerce integration (Sendit)

3. API VS. EDI

API is often mentioned "as one of the greatest innovations in logistics together with drones for a parcel delivering or autonomous trucks" (EFT, 2016). It also

mentioned API is the successor of EDI, which is being considered as a relict of the past and API will be the only "standard" of future data exchange in logistics and not only in logistics. However, although the unarguable role, which API will have in the future, EDI is still the simplest, the most effective tool for data exchange. Research shows that EDI didn't even achieve its full potential on the market. API for sure will enrich an offer of integration services of LSP's with its business partners, at least for real-time tracking and tracing or communications with onboard systems of vehicles. However, EDI still will the leading way of data exchange. Benefits from digital data exchange are the same if we are talking about EDI or API, so API doesn't bring much difference here it is just another way of electronic data transfer between systems. In case of EDI, which exists on the for many, many years in most of cases companies are using common messages standards, which are crucial in case of cooperating on the international market in cooperation with many business partners. In case of API, there is a big gap over here, there aren't existing standards which will correspond to business transaction and which could be applied to so many business cases and scenarios as EDI which carries many years of experience on the market within its standards. EDI is still the most effective cost-wise tool which is not insignificant, there are existing ways of import and export data to and from systems. API connections need to program, so specialized staff needs to be employed. API by its nature impacts on security for systems as another access point, which requires monitoring.

Business partners will still use EDI for data and documents exchange if it works well, why change? Besides employees knows EDI but not necessary API, so this could another obstacle.

Table 1. Comparing EDI and API

EDI	API
Exchange of business documents between business partners with standardized messages through communication protocols like: FTP, AS2 ...	The interface which allows on the interaction between systems with the help of HTTP protocol.
Implementation	
- Easy for integration especially with older systems - Often requires EDI service providers for integration with business partners and messages translations. - In general lower cost of implementation	- Not compatible with older systems - Developers have to learn new technology - Requires to employ API experts or use the third-party services
Functionalities	
- Information exchanged in minutes - Commonly used by business partners and very, millions of transactions. - Information is restricted to EDI standards	- Information exchanged in seconds - Requires more secure systems and monitoring. - unstandardized form of data

Source: https://apifriends.com/others/api-versus-edi

Besides the very big potential of API, LSP and will use EDI for quite a time sill as a major method of data exchange, API will be used as an additional tool for data exchange or to enrich their services offer like shipment tracking. Raben Group in a very elegant way join both technologies and it uses standardized EDI message (GS1 XML) together with WEB API based on SOAP protocol. API is one of many communication channels.

4. RESEARCH RESULTS

LSP

Research has been done based on provided API documentation by 6 LSP: CEVA Logistics, DHL, Schenker, Dachser, RABEN, UPS. In total 106 interfaces have been identified, where from 84 were analyzed as far as data scope is concerned. API interfaces were identified in the following focus area: Transport, Warehousing, Master data, and Finance. Among interfaces, the following table contains interfaces responsible to the same or similar business transaction. In this table, there is a generic interface because it had a different name in each of LSP.

Table 2. API interfaces among LSP which occurred more than once

No	Document type	Occurr-ence	Section	Description
1	Transport Order	4	Transport	Transport order contains transport instructions and it is sent from logistics service client to logistics service provider.
2	Transport Order Response	4	Transport	Response on transport order.
3	Transport Status Request	6	Transport	Request information about the status of the transport order.
4	Transport Status Response	6	Transport	Status or status list related to transport order.
5	Transport Document	5	Transport	The request of any accompanying transport readable documents like Delivery note, CMR, label, invoice …
6	Document Response	5		Provision of readable documents most of the cases (PDF, or BASE64 PDF)
7	Transport services	2	Transport	List of accessible logistics services
8	Transport rates	2	Transport	List of accessible logistics service with prices
9	Inbound Instruction	2	Warehousing	Inbound instruction for warehouse
10	Receipt Confirmation	2	Warehousing	Receipt acknowledgement

11	Outbound Instruction	2	Warehousing	Outbound instruction for warehouse
12	Ship Confirmation	2	Magazynowanie	Shipping acknowledgement
13	Inventory Report	2	Warehousing	Inventory report
14	Item Master	2	Master data	Definition, adding, modifying, deleting material master information

Source: author own study

Among identified LSP API interfaces there were many single which occurred just once in one of the LSP.

Table 3. API interfaces among LSP which occurred just once

No	Document type	Occurence	Section	Description
1	RMA Reception	1	Warehousing	Return inbound instruction
2	RMA Reception Confirmation	1	Warehousing	Confirmation of return goods receipt
3	Inventory Adjustment	1	Warehousing	Inventory stock updates
4	Inventory Status Change	1	Warehousing	Inventory stock type change
5	Vendor Master	1	Master data	Update of suppliers database
6	Customer Master	1	Master data	Update of customers database
7	Pacakge dictionary	1	Master data	Packages dictionary
8	ADR information	1	Master data	ADR items dictionary
9	Time in Transit	1	Transport	Transit times between points (addresses)
10	Dangerous goods pre-check	1	Transport	Information about dangerous goods
11	Localizator	1	Transport	Shipments location
12	ProfileHouseBill-List	1	Transport	Shipments list
13	Brokerage	1	Transport	Shipment statuses and references
14	HomeDelivery	1	Transport	Shipment details
15	SSCC	1	Transport	Returns sscc customer's number to use
16	Routing	1	Transport	Route information
17	BookCourier	1	Transport	Parcel carrier booking
18	getMyShipments	1	Transport	List of shipments
19	getReturnWaybill	1	Transport	Waybill generation
20	getLabelsData	1	Transport	Sends label information
21	getPNP	1	Transport	Report of shipments

22	Create Manifest	1	Transport	Create waybill from shipment or group of shipments
23	getPalletInfo	1	Transport	Collecting customer pallet numbers
26	getCashOnDeliveryReport	1	Finance	COD report
27	getInvoiceSpec	1	Finance	Invoice specification
28	getInvoiceSpecCompressed	1	Finance	Compressed invoices
29	getFuelFactor	1	Finance	Fuel factor value added to service price
30	getTolleFactor	1	Finance	Road tolls added to transport services

Source: author own study

Platforms

The research has been done based on API specifications provided by 7 logistics platforms in the following categories Transport marketplace (TRANS.EU, Timocom), Parcel carriers integration (Furgonetka, Apaczka), Logistics services integrations (Logintegra, Transporeon), eCommerce integration (Sendit). 174 API interfaces were identified in the following areas: transport, user management, addresses and customers management.

Among interfaces exists the same type interfaces like transport order, the following table contains interfaces which occurred more than on one platform.
A generic name for those interfaces has been applied.

Table 4. API interfaces among logistics platforms which occurred more than once

No	Document type	Occurrence	Area	Description
1	Transport order	6	Transport	Transport order send to platform
2	Delete transport order	4	Transport	Deletion of transport order
3	Get order details	5	Transport	Retrieve transport orders details
4	Get orders	5	Transport	Retrieve a list of transport orders
5	Order rate	3	Transport	Transport order rate
6	Waybill	2	Transport	Waybill
7	Validate order	2	Transport	Validation of transport order
8	Order status	2	Transport	Transport order status
9	Truck offer	2	Transport	Truck offer
10	Truck offer details	2	Transport	Details of truck offer

11	Truck offer delete	2	Transport	Deletion of truck offer
12	Authorization request	3	Administration	Authorization request by an external system
13	Company info	3	Administration	Company information
14	User info	2	Administration	User information
15	Points	6	Loading/ Unloading places	Loading and unloading points information

Source: author own study

There were another 50 singles API (with responses) interfaces which occurred just once, on one platform.

Table 5. API interfaces among LSP which occurred just once

No	Document type	Occurrence	Area	Description
1	Access Token request	1	Administration	Access request by token
2	Find Customer Keys request	1	Master data	The search of customer number
3	Find Customers request	1	Master data	Customers search
4	Find Contact Person Keys request	1	Master data	Contact person number search
5	Find Contact person request	1	Master data	Search contact person
6	Store Contact Person request	1	Master data	Add contact person
7	Delete Contact Person request	1	Master data	Contact person deletion
8	Find Cargo Offer Keys request	1	Transport	The search of transport orders numbers
9	Find Truck Offer Keys request	1	Transport	Search for truck offers numbers
10	Find Truck Offers request	1	Transport	Search for truck offers
11	Find Truck Offers outside search request	1	Transport	Search for truck offers outside collaboration group
12	getPackageFormUrl	1	Transport	Generation of web form for transport order
13	addPackageToTracking	1	Transport	Adding package to tracking system
14	getAvailablePickupHours	1	Transport	Get avaialable pick hours
15	get balance	1	Transport	Get settlements to balance with customer

16	getRegulations	1	Transport	Get carrier's regulations
17	service_structure	1	Transport	Service structure
18	edit transport	1	Transport	Transport order modification
19	status	1	System	System status check
20	SpUserField	1	Master data	Get user field value
21	SpAddressList	1	Master data	Ger addresses list
22	SpAddressAdd	1	Master data	Add address
23	SpAddressDelete	1	Master data	Delete address
24	SpOrderConfirm	1	Transport	Transport order confirmation
25	SpProtocolGenerate	1	Transport	Protocol generation

Source: author own study

5. CONCLUSIONS

Detail analysis of API data structures confirms very big differentiation of data definitions, naming and data structures. One of the examples can be API responsible for providing transport order status where the name for such interface is different on each platform and LSP: getTrackandTrace, OrderStatus, Shipment status, transport status request, Brokerage, track. Besides codes and description are different everywhere. Another example is transport order on the platform which have following names: Cargo_offer, Order_save, transport_creation, order_send, create_package, store_cargo offer request, Add a load offer

What is worth to notice is that even is that that we often we API interfaces which allows passing human-readable documents like PDF or some graphic formats. These documents are labels, invoices, delivery notes etc… It is because these documents are still required because of law regulations, audits or because processes were not fully adjusted to effectiveness which EDI or API offers. As for an example of an interesting interface, we can mention CO2 emissions or geo-localization.

The other thing which characterizes API interfaces especially those on platforms are interfaces which are only to be used by computer programs, their function is to retrieve information which is necessary to accomplish further steps in the program function, which is of course according to the spirit of API, where external data can be treated like local resources.

5.1. Reasons for API

Why API is used? API interfaces are fast, the response is a real-time in the worst cases in seconds. API can generate new possibilities of system integration and thanks to API services offered by LSP or platforms can be more complete. For example for LSP integration to third party services like:

- E-Commerce platforms, which can generate transport orders in LSP systems, or check the stock availability.
- Integration with the system supporting tracking and tracing of shipments or logistics units.
- Integration with systems of carriers and other LSP.
- Integration with transport marketplaces
- Integration with logistics services integration platforms and parcel carriers
- Selling and suppliers systems and ERP's
- Mobile and on-board devices

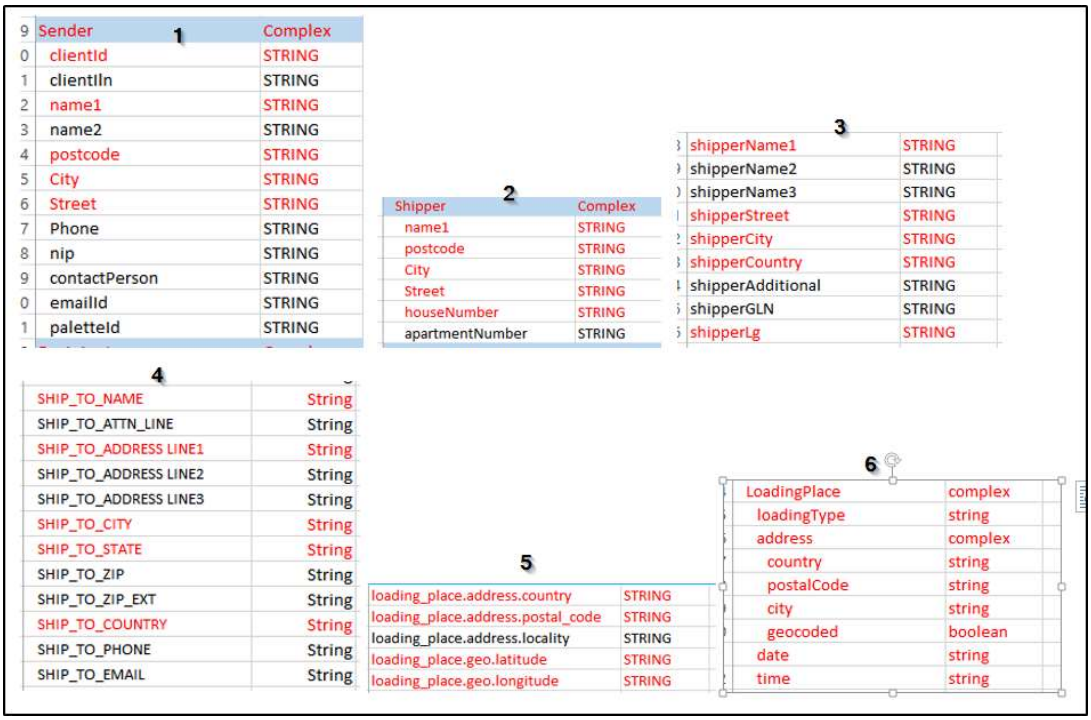
For platforms we can add the following reasons:

- API open new possibilities for integration with LSP systems, tracking systems digital maps etc.
- Technologically wise, API is a natural way of communication between web applications, which are now 95% of a new application on the market.

5.2. Why API needs standardization and how to do this

Detailed semantic data analysis shows that the same business terms have a different naming or format in particular interfaces, the same for group data elements like address, COD information, logistics unit, Dims of a logistics unit. Information scope and field name are different in each interface. Codes or code lists used e.g. for shipment status, or reason for rejection, are different on each platform and in each LSP. For the company who cooperate with several LSP and from time to time with the platform it can be a nightmare they would need a translation table to convert those to additional probably another one in-house standard. Below diagrams shows the complex data model for Address from different API interfaces which shows exactly data field naming and structure of this address record is completely different in each of the interfaces.

Figure 3. Examples of complex data element (Address), from six different API interfaces.

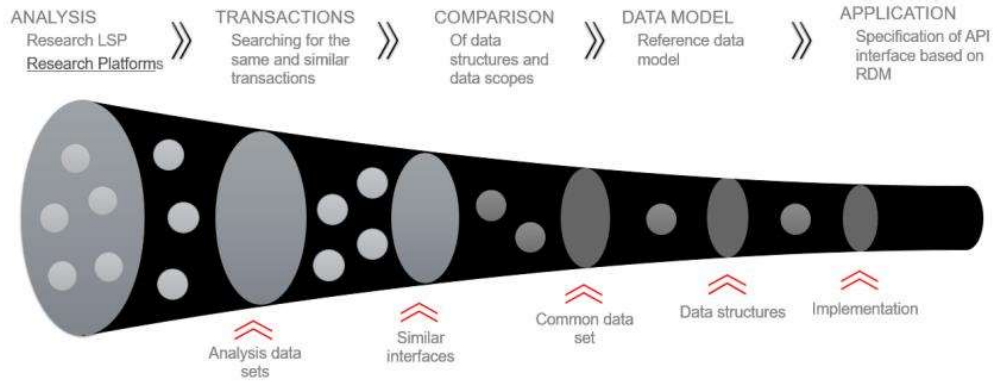


Source: Author own study

After the analysis of interfaces and its data structures it seems that awareness of the majority of the users is ending on data (file) format json or xml, the point that json or xml file can have a completely different data structures and naming of data elements. Which leads to building a new API interfaces for the same business activity with another business partner (e.g. another LSP). So there seems to be a big area for harmonization of API interfaces, the best on the level of the reference data model, which would be technologically agnostic and could be applied for both types of API REST – json or SOAP – xml and actually not only for API .

On the below diagram there are some steps which need to be taken to do a harmonization of API interfaces. This research concludes first three steps of below road map which is a basis for work on the reference data model used in transport and logistics sector of course in the part which were covered by identified API interfaces.
First step – analysis of data sets within API interfaces both platforms and LSP,
Second – step compare and identify interfaces of the same type, responsible for the same or similar business transactions.
The third step – prepare common data sets per API transactions to cover requirements from different LSP's and platforms.

Figure 4. Road map for API data structures standardization



Source: author own study

The steps ahead:
The fourth step – Create or adopt a reference data model, which defines business data terms, and grouped business data terms to create a semantic model for API's based on those business terms. The RDM would contain for example a grouped business term for address.
Fifth step – Create an API specification about reference data model created in step 4.

In Europe and Worldwide there are many initiatives which could help in further work on API harmonization like:

- UN/CEFACT core components for Transport and logistics and its adoption to API interfaces,
- eCMR GS1 France which will utilize UN/CEFACT core components for electronic international waybill,
- GS1 Global Office Semantic Model Group for Order to cash cycle – dictionary for data terms and semantic data models for messages to cash processes.

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