Paper number ITS-XXXX

Freight Information Exchange for eCall

Abstract

eCall, an emergency call generated either automatically via activation of in-vehicle sensors or manually by the vehicle occupants; that, when activated, provides notification that there has been an incident to the most appropriate Public Safety Answering Point (PSAP) carrying a defined standardized minimum set of data (MSD) including relevant location information , became a regulated requirement for new type approved M1 and N1 vehicles under EN regulation as from April 2018. This paper describes how eCall information can be enhanced with freight information to provide the PSAP with important information about, potentially dangerous, freight loaded in the vehicle, to allow a faster response and secure the first responders. The paper describes the new standard preparing the eCall interfaces for the new eFTI standards and defines the prerequisites for the eFTI standards that need to be fulfilled by eFTI to allow the access to the necessary information for eCall. and shows a migrations path from today's available information to the new initiative eFTI (electronic Freight Transport Information) introduced by the European Commission.

Keywords: ECALL, EFTI, DANGEROUS GOODS

Background – Pan European eCall

Pan European eCall is an initiative with the purpose to bring rapid assistance to motorists involved in a collision anywhere in the European Union.

In case of a crash, an eCall-equipped car automatically calls the nearest emergency centre. Even if no passenger is able to speak, e.g. due to injuries, a 'Minimum Set of Data' (MSD) is sent, which includes the exact location of the crash site. Shortly after the accident, emergency services therefore know that there has been an accident, and where exactly. This cuts emergency services response time drastically.

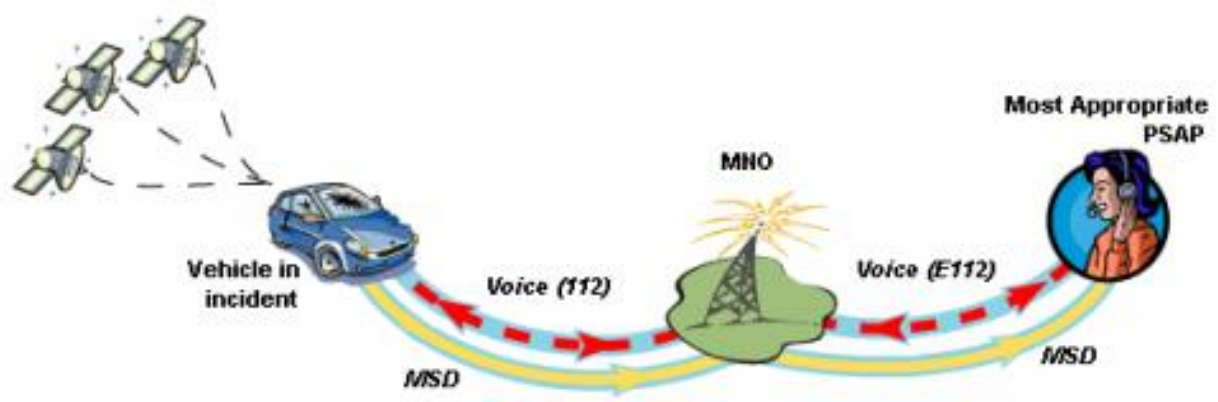

Figure 1- European eCall Architecture

An eCall can also be manually activated by pushing a button inside the car. When (the aftermath of) an accident is witnessed, one can report it and thus automatically give the precise location. In normal

working mode the eCall system 'sleeps': as such it does not facilitate any form of vehicle tracking and tracing.
eCall is supported in all European Countries since the beginning of 2018. Passenger cars (M1 and N1) that are type approved as of April 2018 have to support eCall.

General overview

Following the standard EN15722 an eCall MSD can optionally contain additional data that shall be decoded using an ASN.1 decoding recipe referenced by the so called OID data element. After decoding, the receiving system can use that additional data in the emergency process. The inclusion of cargo related data is described by EN16405 which contains two Schema's for additional data: Schema A and Schema B. Schema A includes all data in the MSD. If Schema B is used, the receiving system receives data elements that can be used to retrieve data from a remote source. The relevant data elements are:

Table 1- EN16405 OID

data				*encoded as OCTET STRING*
...				-
cargoInformationEndpoint			O	
endpointParameters	PrintableString		M	Parameters needed to contact the endpoint, following the specified protocol.
endpointProtocol	RELATIVE-OID		M	Relative object identifier designating the protocol to use to retrieve information through the above named endpointParameters.

The envisaged mode of operation is that a receiving system uses the endpointProtocol-identifier to determine how and where to get the cargo information and how the retrieved information is encoded. The endpointParameters contain the parameters necessary to do the retrieval. Amongst the parameters can be: a URI (if the protocol does not use a fixed URI), a key specific for the vehicle and any other parameters needed. The proposed mechanism offers a very flexible way of disclosing cargo information in an emergency situation. Pretty much every freight/cargo information system that complies with the requirements specified in this standard can be used to offer the data, as long as any PSAP system is able to reach the information endpoint and has the correct procedures implemented.
The harsh reality is that most emergency services have systems that are not able to freely connect to every system and not every transport company wants to open up their systems to anyone. Also, the burden for both PSAP system developers as those of transport management systems (TMS) to reinvent the wheel over and over again is considered counterproductive. A new technical specification offers the means to standardise parts of the information exchange process, without limiting the flexibility offered by EN16405.
Addressing the retrieval of cargo information, three elements can be identified that are open to

standardisation: the cargo information endpoint itself (i.e. a more or less central source of information), the way the PSAP connects to the endpoint (i.e. the connect and exchange mechanism) and, thirdly, the way the data is coded and should be decoded. The technical specification offers a standardised approach for the latter two, and includes a suggestion for the first, whilst using existing solutions.

Exchange of data

In order to be able to receive accurate information about the loaded goods the PSAP needs the actual and relevant information about the current freight transport that activated the eCall.
The European Commission has launched a legislative process to harmonize the Electronic freight transport information (eFTI) and to provide the legislative framework and a basic architecture for the exchange of freight transport information.

eCall Requirements for access to electronic Freight Information

PSAP requirements
Previous research has laid down some ground rules for information that is exchanged within the eCall paradigm. Basically, any information should adhere to these requirements:

- Information shall be 'machine interpretable'
- Information shall either be sent in human readable form, or automatically be translated
- Information shall be concise and well structured
- Information shall be accurate and up to date

Focussing on the emergency process, research has shown that PSAPs and emergency services need specific information in case of an accident with the commercial vehicle, vital in ensuring that the right resources are dispatched. Obviously, a large part of this need overlaps with what is already implemented with the basic eCall mechanism, these elements are marked with an asterisk:

1. Exact location of incident/collision/vehicle including direction of travel, prior to the collision or incident* (via MSD)
2. Vehicle Information:
   - VIN* (via MSD)
   - Make, Model, Type (Rigid, Articulated) * (via EUCARIS, local registry or VIN decoder)
   - Type of fuel (Diesel/LPG/Electric) * (via EUCARIS or local registry)
   - Registration number* (via EUCARIS or local registry)
3. Vehicle Cargo
   - Phone number of Expert (optional)
   - Sender details (optional)
   - Receiver details (optional)
   - Contains Dangerous Goods?

   If yes:
      - UN-Number
      - Quantity

- Packaging danger level code (optional)
- Kemmler Code (optional)

If no:

- Quantity (optional)
- Type of good (optional)

This paper focusses on element 3 “vehicle Cargo”.

Information providers requirements

The information providers (mostly transport companies) benefit from a speedy emergency and recovery process but do have requirements as well. They obviously want to limit the resources spent to be able to share information with the PSAPs. But perhaps more important is the security and confidentiality of the data.

It is a necessity that only certified PSAPs are allowed to use the interface for eCall and that a request for data can only be made when an eCall was received. Any (exchange) protocol should ensure both requirements. The first condition can be met by several security mechanisms including the exchange of keys or based on private connections.

To ensure that a request is only made in case an eCall was received, the exchange protocol should involve one or more key elements that come from the MSD provided by an IVS in a vehicle and are not otherwise known, other than with the freight information service provider. A random number serves this purpose, whereas well-known keys like VIN or the license plate number cannot be used as a key (although the key can be the VIN encrypted with the private key of the service provider).

The Standard EN16405

EN16405 uses the optional additional data concept that is part of the eCall MSD as standardized in EN15722 to include cargo related data. The PSAP receives and can decode this information, to cover the requirements expressed in point 3 of the previous paragraph.

Two schema’s are defined in EN16405 for that purpose: A and B. Schema A is designed to include cargo information directly in the MSD. As a result of the limited space available, the information itself is limited as well. However, Schema A has some advantages like the immediate availability of information to the emergency process and its applicability to fixed transports.

Schema B lessens the need for alterations to the implementation in the vehicles by offering the information from a remote source (i.e. not the vehicle itself). The optional additional data part of the MSD contains information for a receiving system to retrieve the cargo information from that source: endpointProtocolID and endpointParameters.

The endpointProtocolID serves as an identification that can (programmatically) be used to know where to retrieve the data, how the endpointParameters fit into the retrieval process and how the received data must be decoded. For this an online or offline “library” will be defined and maintained that contains that information in a structured way, so it can be used easily in receiving systems.

As an example: this is the (structured) information that is contained in the library for

endpointProtocolID 31.5:

endpontProtocolID	31.5
retrieval method	HTTP POST
- base URI	https://nl.cargo.info/eCallRequest
- GET parameters	-
- POST parameters	* vehicle = endpointParameters.V * key = endpointParameter.K * vin = VIN
- request body	(empty)
encoding of response	XML
- XSD	https://nl.cargo.info/xsd/encoding.xsd

While developing the PSAP software these specifications should be implemented so the PSAP system can use the information from the MSD. Such MSD can, for example, contain the following:

endpointProtocolID	31.5
endpointParameters	V=2415;K= 68ef8998-1e15-4189-8466-497b2039bbe4

The PSAP software will now, upon receiving that MSD: (a) determine which implemented profile to use (eg. 31.5), (b) embed the parameters from the MSD into the request (eg. V, K and VIN), (c) obtain (using the URI) and decode (using the decoding scheme) the data and (d) present the data to the operator and send it through to the emergency services.

Available approaches to encode and exchange data

The new specification is designed to (re)use existing approaches for both encoding and exchanging of (cargo) data (in order to limit the amount of time and money needed to implement the standard with all stakeholders). This paragraph is meant as an inventory of such existing approaches.

eFTI

eFTI is still in the early stages of specification, so as the following paragraphs will show, not much is known at the time. However, it is envisaged that eFTI will play a major role in the electronification of cargo information and as such it is important to keep a link with eCall developments.

Data exchange under eFTI

The exchange protocol for eFTI is not defined yet and is under discussion. It is expected that the standard will not be defined until 2021.

The principal structure, as shown here, is based on National Authorities. Those will get access to the freight information through a national authority access point. This access point will ensure

authentication, access rights and privacy for the national authorities and will ensure that the information provided by the eFTI platform is correct. How this will be achieved is still under discussion.

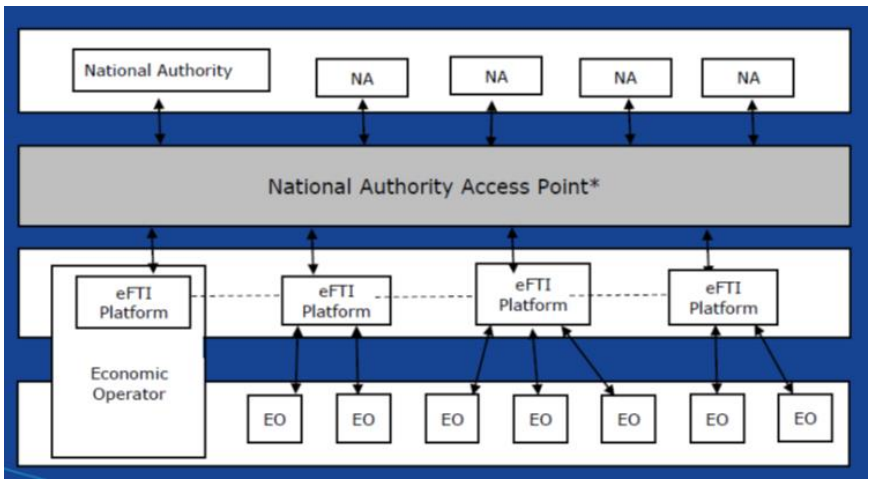

Figure 2- eFTI Architecture (Source: European Commission)

Data encoding under eFTI

The eFTI platform returns either the complete freight transport information of the transport corresponding to the provided key or a limited set. The data is structured following the yet to be developed eFTI standard.

EUCARIS

EUCARIS is the European network via which vehicle registration information is shared between member states. It has a setup that has similarities with the foreseen eFTI approach with national information endpoints that serve as connection point for national bodies entitled to use the data provided by EUCARIS.

Data exchange under EUCARIS

The normal procedure for a EUCARIS request is to first query the local registry database and, if nothing is found, make a broad query to all attached member states. This approach is not necessary for the retrieval of cargo information, simply because either the endpointProtocolID, or the endpointParameters, or the combination of the two suffices to unambiguously determine where the information about the cargo can be obtained.

The benefit of EUCARIS is that PSAPs already use EUCARIS to retrieve additional information about the vehicle based on the VIN. This means that a secure connection exists and basic retrieval means are in place on both sides. EUCARIS already made progress on extending the interface from their end to allow for the retrieval of cargo information and to connect to external freight transport databases.

The envisaged method of operation is that the PSAP queries EUCARIS with a request that contains at least the VIN number of the vehicle and the contents of both endpointProtocolID and endpointParameters. Since a connection between PSAP and EUCARIS is already established and such

request is only accepted from a PSAP, that part of the requirements of the information providers is covered.

The next step for the National EUCARIS partner is to determine where to retrieve the information. This is done based on the endpointProtocolID and a register. That register points to the National Cargo Information Authority which handles the protocol. This NCIA can be the partner itself, or directly connected to this partner or connected to a different EUCARIS partner. In the latter two cases the request is relayed to either the NCIA or the other partner and a received response is proxied back to the requesting PSAP. If the EUCARIS partner itself acts as the designated NCIA for that protocol, the request is handled internally. In any case, the ultimate data provider can determine that the request is based on a legitimate eCall since all parameters from the MSD are part of the request.

Data encoding under EUCARIS

Given that EUCARIS is not a cargo information provider, no encoding scheme exists nor is envisaged.

UN/CEFACT

UN/CEFACT is the United Nations Centre for Trade Facilitation and Electronic Business. It was established as an intergovernmental body of the United Nations Economic Commission for Europe (UNECE) in 1996 and evolved from UNECE's long tradition of work in trade facilitation which began in 1957. Given that UN/CEFACT only deals with the encoding of data, no exchange mechanism exists nor is envisaged.

UN/CEFACT defines an extended encoding scheme for cargo related data. Relevant for (at least dangerous goods related) transports and eCall is this part:

```
<xs:element name="ApplicableTransportDangerousGoods" type="ram:TransportDangerousGoodsType"
minOccurs="0" maxOccurs="unbounded">
  <xs:annotation>
    <xs:documentation source="BN/BN">Transport Dangerous Goods</xs:documentation>
  </xs:annotation>
 </xs:element>
```

The data of this element is encoded using the subtype TransportDangerousGoodsType which includes among others following information:

- UNDGIdentificationCode
- DangerousGoodsRegulationCodeType
- TechnicalName
- UpperPartOrangeHazardPlacardID
- LowerPartOrangeHazardPlacardID
- PackagingDangerLevelCode
- TransportExpertTradeContact
- FlashpointTemperatureMeasurement

This definition contains all information required by the PSAPs and the emergency services.

Envisaged configurations

EN16405 lays down the technical standard for (facilitating) the exchange of cargo data in case of an incident. The standard does not describe the model and relations between PSAP and data providers as

this goes beyond the scope of the standard. So the basic principle based on EN16405 is that all PSAPs need to interact with all suppliers of external cargo data and, as a result, need to understand all protocols (ie. colored lines) and all data formats (ie. coloured document icons).

Possible technical optimisations are standardisation of the format and/or the protocol, since this can alleviate the development on both sides. This however does not solve the need for multiple connections between PSAPs and data sources, implying the same number of negotiations between parties.

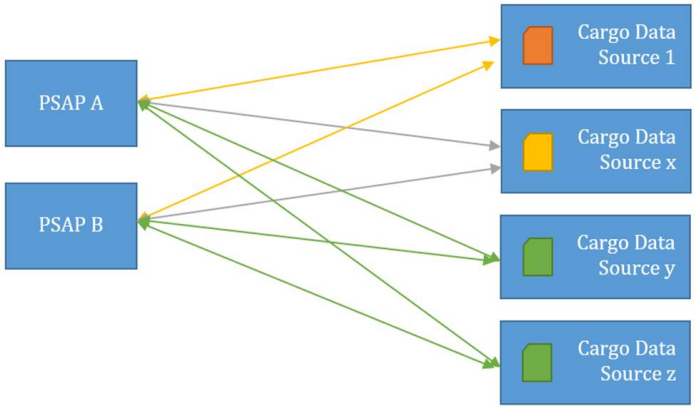

Figure 3- Interaction PSAPs with Cargo Data Sources

EN16405 with EUCARIS

It is clear that in the long run eFTI can and will play a major role in making cargo information available to the emergency services via eCall. While eFTI is still in the sketching stage, EUCARIS can be used as a proper alternative.

EUCARIS can solve the unwanted situation described before by acting as a man in the middle between PSAPs and data sources. This model is depicted in the following figure.

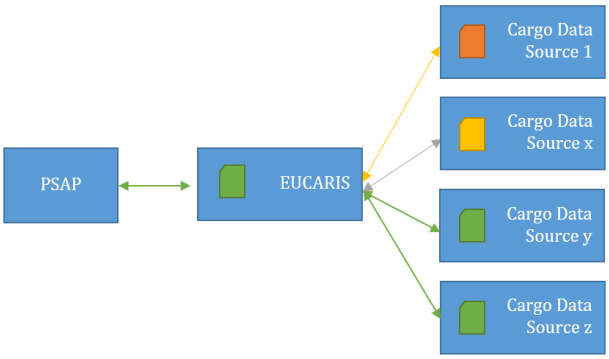

Figure 4- Interaction PSAPs with Cargo Data Sources with EUCARIS

The development impact on PSAPs can be greatly reduced since most PSAPs have already their own, existing, connection to EUCARIS. Based on the new specification, that connection is extended with the standardised calls and data format as defined above by UN/CEFACT. The EUCARIS network itself implements the different protocols and formats and a converter.

EN16405 with eFTI

eFTI will lead to two optimisations: (a) the number of cargo data providers to connect to will lower as parties will go behind the eFTI portal, so less connections to maintain. And (b) the exchange between PSAP and eFTI portal is standardised.

Whilst being rolled out, eFTI in itself won't make the use of EUCARIS less necessary. As can be seen in the figure below, the implementation of eFTI makes the situation less complex, but not as lean as the EUCARIS situation.

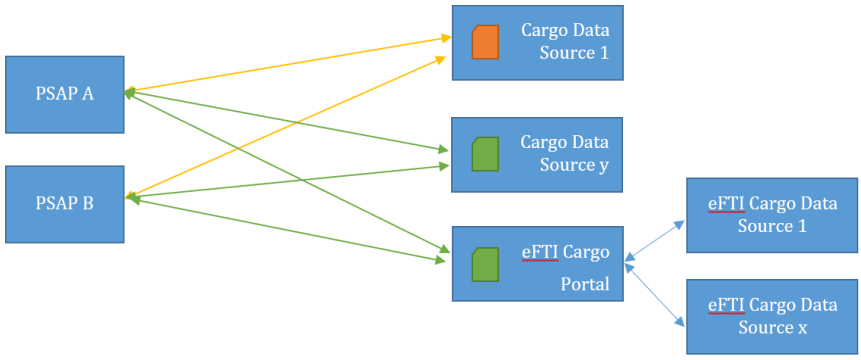

Figure 5- Interaction PSAPs with Cargo Data Sources with eFTI

EN16405 with EUCARIS and eFTI combined

Fortunately, both models can co-exist and the combination is even stronger:

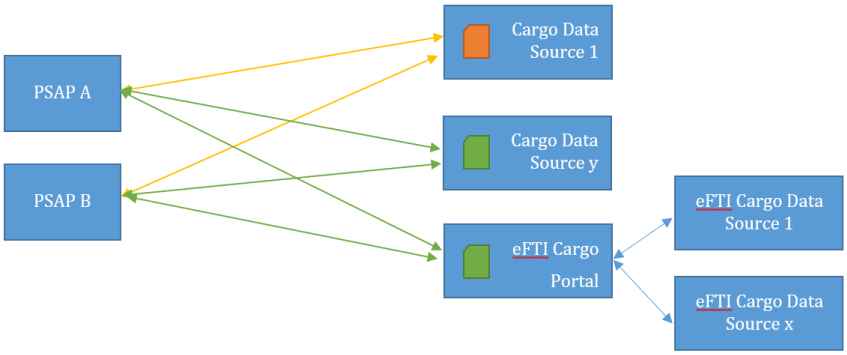

Figure 6- Interaction PSAPs with Cargo Data Sources with EUCARIS and eFTI

Whether eFTI or EUCARIS is playing the middleman role, in both situations there are in fact two exchanges of data: between the PSAP and the middleman and between the middleman and the data provider. Towards the PSAPs the middlemen, ie. the NA (eFTI) or NCIA (EUCARIS), should implement only one exchange mechanism, which currently defaults to the EUCARIS data exchange mechanism. Towards the data providers they (NA/NCIA) need to be flexible enough to support multiple exchange mechanisms, in order for the roll out to be as broad as possible. Any provider that has not yet an exchange mechanism in place should, obviously, be encouraged to use the generic exchange mechanism.

The same goes for the encoding of data. Between NA/NCIA and PSAP the best option is to use a encoding scheme that uses the UN/CEFACT subtype TransportDangerousGoodsType. Any provider that needs to implement data encoding needs to adhere to this as well, with the benefit of doing work that needs to be done in the near future in any event. But providers that currently already have a data exchange up and running, using different encoding (like based on the Dutch EBA schema) should find an open door with the NA/NCIA.

Conclusion

The new technical specification defines the way how PSAPs can retrieve dangerous goods information from Freight Information databases. The proposed solution is a combination of EUCARIS and eFTI using the UN/CEFACT protocol as exchange standard. For the migration until eFTI is defined and implemented, a pure EUCARIS based solution could be used.

References

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