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Degadt, Wouter; Braet, Olivier

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Wouter Degadt & Olivier Braet

Next Generation Intelligent Transport Systems: a multidimensional framework for eCall implementation

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Wouter Degadt
Interdisciplinary Institute for Broadband Technology – Centre for Studies on Media, Information and Telecommunication (IBBT-SMIT)
Free University of Brussels (VUB)
Pleinlaan 2
1050 Brussels
Wouter.degadt@vub.ac.be

Olivier Braet
Interdisciplinary Institute for Broadband Technology – Centre for Studies on Media, Information and Telecommunication (IBBT-SMIT)
Free University of Brussels (VUB)
Pleinlaan 2
1050 Brussels
Olivier.braet@vub.ac.be

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ABSTRACT

The present use of *Intelligent Transport Systems* (ITS) can be defined as a hybrid between information and communication technologies to improve different aspects of mobility and transport. The potential value of the next generation ITS can be assessed as an integrated array of services satisfying customer preferences, optimising policy objectives and generating business revenues. Based on industry interviews, the analysis of a traffic information service and an 'emergency call' service permitted the multidimensional appreciation of deployment scenarios of these next generation Intelligent Transport Systems.

The implementation of an on-board *emergency call* (eCall) is an ITS service which has already been deployed in different countries. Several private and public initiatives have already resulted into preliminary and purely private eCall services, mainly proprietary to the car industry, each with different underlying revenue and cost models. On the European level, a *Memorandum of Understanding* (MoU) instigated on the national enactment to implement a standardised eCall system.

The research question involved in this paper is whether the specified ecosystem for the Belgian case confirms that all stakeholders have a particular interest in the effectuation of eCall. The findings are the result of a case study performed within the Flemish IBBT research project NextGenITS.

I. INTRODUCTION

Road safety, energy efficiency and traffic congestion are the main challenges currently facing European transportation, according to the Intelligent Car Initiative (ICI) launched by the European Commission in 2006. The report was lauded in the European Parliament in 2008, calls for more effort from industry to promote ICT-based solutions in transport.

Road safety is a social mobility problem of international dimensions. More than 1.2 million people are killed on the world's roads annually. The European Union (EU) has set the goal to half the number of people killed between 2000 and 2010. In the year 2009, road accidents killed over 35 000 people in the European Union and injured more than 1.5 million[1].

Implementation of an eCall system in Belgium in accordance with European directives will require technical and business solutions. From a technical point of view an upgrade of the Public Safety Answering Point (PSAP) is a necessary public contribution while the development of a hardware on-board unit (OBU) and network communication technology will require a private investment.

A. Methodology

This paper follows the business modelling methodology, involving the collection of relevant information pertaining to organizational, technical and service design choices to be taken into account by all public and private actors involved, in order to obtain a detailed view of the business-level motives surrounding the introduction of these technologies.

Confining the eCall ecosystem allowed determination of different actors and stakeholders and categorisation into *four different viewpoints*. The *public perspective (1)* considers the mandatory push of the European Commission and the desiderata of the Belgian government. Secondly, and inherently more optional from a service point of view, the *private business perspective (2)* induces an array of value-added services on top of the mandatory eCall. The *user or customer viewpoint (3)* is an essential consideration when assessing the potential market take-up of eCall. The aftermarket scenario, where additional value-added services become available through proper connected devices, is of particular interest to the users value perception. A fourth viewpoint combines the three previous scopes in a *hybrid model (4)*.

This hybrid model is used as a theoretical framework and adapted to the Belgian case to define possible eCall implementation scenarios. Four different consequences are taken into account upon implementation of the Belgian eCall system: the allocation of responsibility, the allocation of cost, the allocation of value-added service and the perception of value-added service.

B. eCall principle

From a technical point of view, an eCall system should adhere to the following general principles.

- Establish a link between a *vehicle* and the relevant *emergency point* (PSAP – Public Service Answering Point)
- *Automated* and/or *manual* trigger of an emergency call
- Initial data connection (MSD), after verification extended with the optional full data (FSD) and voice link
- Verification: private *service providers* can offer PSAP filtering to limit false alarms and additional services (bCall: breakdown call)

These technical principles are to be extended with a business point of view dynamic. The central technical concept for the NextGenITS project and the eCall sub-package is the role of PSAP (Public Service Answering Point), and more specifically the distinction between a PSAP1 (that filters calls and routs them to the relevant emergency actor) and PSAP2 (that responds to the emergency by sending out the aid). Since the introduction of this role translates into new business roles that can be performed by different business actors, the choice of who will perform this role and whether the choice of PSAP will be left to the end-user or not, is critical in understanding the business-level scenarios that could emerge in a real market place.

C. Socio-economic impact

Benefits of a full and well-performing eCall system are mostly demonstrated by socio-economic criteria. These criteria are used to gauge the reduction of various traffic and information (in-)efficiency statistics.

Perhaps the most important factor is the reduction of the *'Golden Hour'*, mostly defined as the timeframe to deliver emergency help. An automated emergency call facilitating gps-location of the incident could reduce the time needed for emergency help to reach the communicated location. Lives will be saved or other medical consequences of a crash can be minimised. These customer/citizens benefits can be used to raise customer awareness of personal security benefits. High-level commitment on positive communication of eCall rollout by industry and government stakeholders is vital to raise this customer awareness. Willingness to pay, however, tends to be low as public road safety is seen more as a public service rather than a private service.[2]

The notion of a golden hour implies more socio-economic benefits than merely more efficient help towards accident victims. Also, the risk of further accidents on the scene can be reduced by intervention of police instances. Moreover, the impact of an accident on traffic can be reduced by a fast-paced intervention. eCall architecture should enable a well-organised emergency operation by provisioning better information on the event and the context.[3]

Clearly, most concerned stakeholders are public actors (health, emergency, road and security sectors), and in a lesser extent private insurance companies and road/bridges infrastructures operators. All involved industries should be concerned to confirm the expected benefits. Those who invest in equipping the vehicles and transferring the calls - in short, upgrading the end-to-end service provisioning – should get compensation from those in the value network who receive benefits from this effort. This balancing of eCall rollout costs and distributed value capturing is the key to a successful market take-up.[12]

D. Communication technology

Connectivity is vital when it comes to the deployment of an emergency call. Currently all mobile handsets can be connected to an emergency operator by dialling 112. Even when the keyboard is locked, most mobile phones will activate when 112 is dialled. European legislation has compelled all operators to prioritise 112-calls. Even phones without a Subscriber Identity Module (SIM) card can make a connection to the emergency operator. Wherever GSM coverage is sufficient, a mobile phone can contact over any mobile network an emergency call centre.

The single European emergency call number (112) must remain free of charge, even from public pay telephones. The single international access code (00) is also maintained.

This philosophy is perpetuated in the implementation of eCall. Connectivity should be guaranteed and independent of network provider. Two technical options are currently the preferred modes of connectivity: the SMS based solution, and in band modem.[5]

- *SMS Based solution*: the SMS based solution is a popular solution for private companies like Volvo On Call and PSA. Voice and data take different routes to the same PSAP. It appeared however to be slightly slower and less reliable than the in band modem solution.
- *In band modem*: the in band modem technology transfers voice and data over the same channel across different carriers to the same PSAP. Currently state-of-the-art based on this network solution is used by General Motors (GM). Their product is called On Star.

Practical analysis of the SMS based solution reveals slower on connectivity time and a less reliable technical solution. In band modem permits a more reliable and instant connection. However, recent market developments reveal technical solutions that support both modes of connectivity.[6]

Caller location should be available according to EU e112 principles. Every caller contacting emergency services should have its location triangulated and made available to the emergency call centre. Belgium has a history of infringement procedures opened by the EU on concerns of the non-availability of caller location information.[9] Deployment of eCall in Belgium will make gps location available upon the triggering of an eCall, which is more accurate than triangulation. Similar barriers, mostly privacy-related, arise when user movement and location can be tracked by an OBU.

II. eCALL STATUS IN BELGIUM

Estimates indicate that 2,500 lives could be saved in the EU every year and 15% of serious injuries avoided if all European cars were equipped with eCall.[1] For reasons of road safety, the European Commission issued a Memorandum of Understanding (II.A) as an indicator of policy intent. Upon deployment of eCall in the Belgian case, this heading outlines actors and stakeholders of the Belgian ecosystem (II.B).

A. European Commission Memorandum of Understanding

Twenty-three member states are currently committed to the eCall MoU, with France and the United Kingdom being the key non-signatories.

Belgium signed the MoU on the 4th of May 2010. Several private transport and automotive organisations, as well as three non-European countries have signed the MoU.

The European Automobile Manufacturers' Association (ACEA) has proposed different types of eCall solutions in line with the planned voluntary agreement with the EC to introduce eCall as a standard optional feature in all new type vehicle models. These solutions will offer vehicle manufacturers flexibility in terms of cost and features to build a telematics service package and price it cost efficiently for end consumers. The range of solutions will also allow vehicle manufacturers to offer this for existing and new vehicle models, thereby boosting the market for eCall systems in Europe.[9]

The Memorandum of Understanding (MoU) is seen as an *intention*, not as an obligation, for Member States of the European Union to commit to the requirements of an upgraded an automated eCall system. More practically this means an investment in the existing emergency intervention infrastructure.[10]

We also make note of the *European eCall Implementation Platform* that aims to be the co-ordination body bringing together all major stakeholders to synchronise their activities. This would significantly accelerate the deployment of eCall at national and European level. The platform will further develop the previous work accomplished by the eCall Driving Group, PSAPs Expert Group and the European Standardisation Organisation. A series of tasks will be co-ordinated to ensure progress on the implementation of eCall across Europe as well as efficient and harmonised deployment of the service. The Platform should allocate responsibilities, adopt decisions by consensus at its plenary meetings and organise campaigns to increase European citizens' awareness of eCall.

B. Stakeholder identification in the Belgian case

1. Ecosystem overview

When it comes to the deployment of eCall in Belgium, all different stakeholders must be identified in the ecosystem. Previously we already confirmed the need of a service provider. The Belgian ecosystem on eCall deployment tends to have more actors than only a service provider.

Figure 1 offers an overview of the different technical actors involved with the roll-out of an eCall service. It depicts the Service Provider (SP) on top, who manages the customer data, the eCall customer data and the eCall case data. Between the 'car in incident' and the emergency operator sit the network provider, the PSAP1 and the PSAP2.

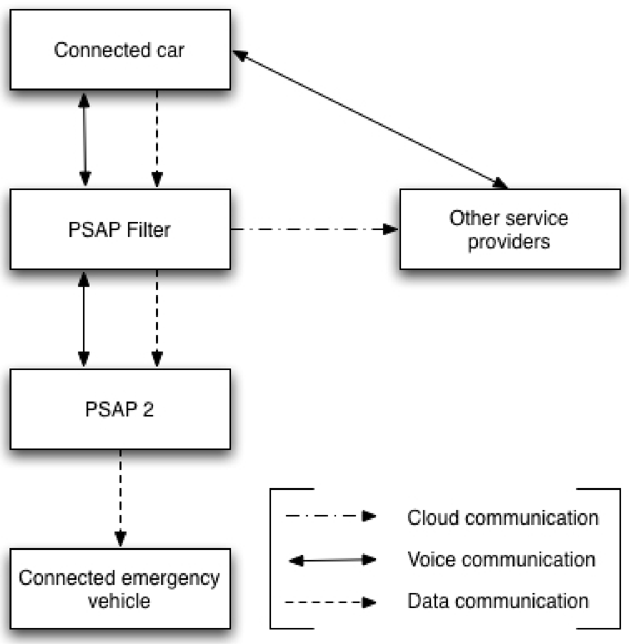

Figure 1: The eCall technical ecosystem

From this technical communication flow of actors the most important stakeholders involved in the delivery and management of an eCall service can be inferred. First, the car manufacturer is involved in the production process, as an on-board communication device is needed to insure eCall connectivity. A Mobile Network Operator (MNO) will carry out mobile data and voice connectivity between all actors. A PSAP filter is needed as a service provider, not only to control the amount of false calls, but also to take up a gatekeeper role towards other service providers.

2. Car manufacturer

One actor that is not explicitly mentioned in figure 1 is the *car manufacturer*, although he plays a critical role in the business value network. In his car, an On-Board Unit (OBU) is integrated. The OBU is delivered with a Global Positioning System (GPS) receiver and a platform on which a Subscriber Identity Module (SIM) can be loaded. This platform can be a classic SIM card, or a platform where a (or several) SIM(s) can be loaded onto. The identity module is linked to the car owner. In our analysis we will make abstraction of the car owner, the driver or the passenger.

3. Mobile Network Operator

When an emergency call is triggered, a connection is made over the mobile network. To provide connection service, a *Mobile Network Operator* (MNO) transfers a voice and data call to the first level PSAP. Which operator will be addressed for the establishment of the eCall connection will be dependent on the issuer of the SIM card, unless the SIM can be virtually downloaded onto a operator independent platform.

4. First level PSAP Filter

Research of existing automated eCall systems have demonstrated the need for a *filtering instance*. The On Star service of General Motors confirms that 95pct of manually or automatically triggered eCalls are false. This would mean an overload of emergency calls for the 112 operator, unless the calls are filtered in advance. A business opportunity arises for a first level PSAP or filtering instance to cope with false calls and the efficiency enhancement of the emergency operator (i.e. the second level PSAP – see II.B.7).

Moreover, the need for a filtering instance is the opportunity to act as a *gatekeeper* towards other service providers. If the triggered call does not require emergency intervention, perhaps other services might be useful to the car user.

5. Other service providers

The PSAP filtering instance can transfer the eCall event to other *service providers* (SP). In that case, the SP receives the Minimum Set of Data (MSD) containing the Vehicle Identification Number (VIN), the GPS location (latitude and longitude) and a timestamp. Upon receiving this information, the SP can provide a value added service (VAS) by combining this information with additional information it manages. Several service providers can be in place. A road operator, a car manufacturer or other service providers can assist when a vehicle breakdown occurs, but no emergency help is needed. In that case the PSAP filter will transfer the call (by use of proper technology) to the relevant service provider without any contact with the emergency operator. This scenario is often referred to as a breakdown call or bCall.

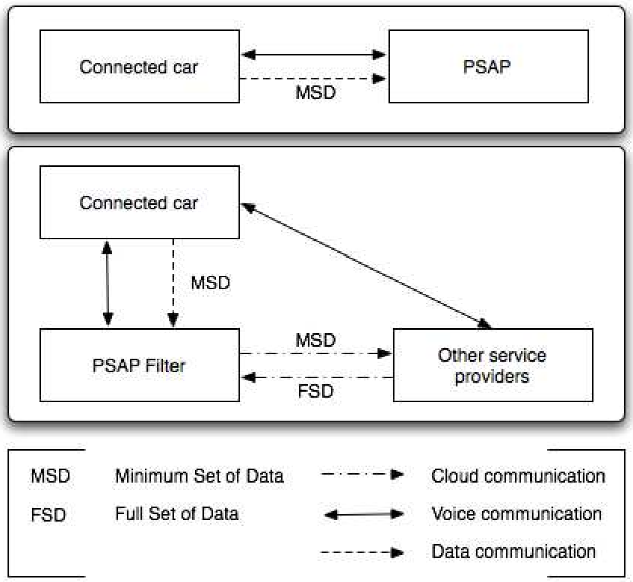

Figure 2: Automated emergency call and the business opportunity of a service provider

The figure above depicts the opportunity of a Service Provider (SP) to provide VAS parallel to the deployment of eCall. The first frame shows the basic set-up of an automated emergency call.

When a (GPS-) connected car is in an accident, a voice and data connection is automatically made over a mobile network to a Public Service Answering Point (PSAP). The MSD is then transferred. Which information on the accident is sent to the PSAP, not the relevance or quality of it, is entirely up to the On-Board Unit (OBU) of the car.

The PSAP or emergency call operator needs a coherent and accurate set of data in order to assist in emergency situations. In the second frame of figure 2, the emergency call is rerouted to a PSAP filter. A car subscribed to the services of an additional service provider (ex. bCall) is recognised by the PSAP filter and sends a Minimum set of Data (MSD) to the relevant SP. The SP can analyse this information and give additional car (-user) information to the emergency operator.

6. System integrator

The *system integrator* should guarantee the standardised use of customer data, vehicle data and case data. Integration of eCall in an OBU can only be successful when the facilitation of different services ensures interoperability. The system integrator holds the important stakeholder role of interoperability. A role that can be attributed to the PSAP filter, seen the gatekeeper characteristics of this actor.

7. Second level PSAP

Once the call is filtered and in case of a real emergency, the *second level PSAP* receives the transferred eCall with a Full Set of Data (FSD) provided by the filtering instance. The emergency operator optionally assists the vehicle through a direct link while emergency intervention is deployed.

C. Stakeholders' points of view

After identification of the actors involved in the service provisioning process of eCall, further analysis of their viewpoints and interests is needed to ensure the establishment of viable business models and differentiation of realistic deployment scenarios. Not only the business actors, but also all possible stakeholders able to influence these various eCall deployment scenarios are taken into account.

1. The consumer centric variation in liberty of choice

The process of eCall deployment in Belgium should always be considered from a user point of view, since the degree of freedom of choice offered to these will impact the final business model scenarios and their feasibility. The optional or mandatory presence of an on-board automated emergency call is the first degree of user liberty of choice. Furthermore, in both cases, a separation can be made when it comes to the degree of customisability. How eCall is delivered from the OBU to the PSAP can depend upon the mode of subscription to value-added services (VAS). The choice of additional value-added services with or on top of the basic eCall functionality confirms the need of an overall service evaluation. Standardisation throughout the entire service provisioning of eCall as a part of different ITS services is essential for the interoperability.

Especially when it comes to the aftermarket implementation of eCall, various factors influence user choices. PSAP connectivity through a Smartphone and proprietary Subscriber Identity Module (SIM) of the car owner/driver requires interoperability of the OBU with all possible handheld devices. Limiting this choice by the provisioning of an aftermarket eCall box with integrated SIM will result in more business-to-business opportunities. From a technical point of view, this aftermarket scenario is only possible when the OBU manufacturer provides an aftermarket device that can easily be installed in existing cars.

Users are found on both the sender and the receiver end of the eCall service chain. First level users create the eCall data and send it onto a network. Second level users are found at the receiving end, making use of all possible data to assist in emergency intervention.

In our ecosystem analysis, we make abstraction of the possible *first level users*. Objectively, the car owner can have a legal or a natural personality. Namely, the actor paying the telecom bill can be an employer, while the person subscribed to the service is an employee. Moreover, the car owner can differ from the car driver who requires emergency help, e.g. a friend or relative driving the car. In another case, someone who sees another person/vehicle in need of emergency help can manually trigger eCall. We also make abstraction of passengers in the vehicle.

Second level users are the emergency vehicle (ambulance, police, fire), the hospital and other receivers of the eCall data. The quality of service provided by emergency operators relies on factors such as availability, quality (accuracy and relevance) and communication of incident data. First of all the MSD and FSD (Minimum and Full Set of Data) need to be registered and available. Secondly, all the available data need to be accurate (ex. location) and relevant for emergency help. Thirdly, this data needs to be communicated with the OBU of the emergency vehicle. Private or public hospitals[1], police stations and fire departments will have to invest in an efficient 'fleet management system'. Communication with the emergency vehicle must be guaranteed at all time.

2. Private sector point of view

The *car manufacturer* or vehicle manufacturer tends to be customer-centric. Originally seen as a product manufacturer, nowadays the role of a car manufacturer extends to the service layer of a value network. The quality of the product is partly confined by the opportunities in the automotive aftermarket. Vehicle manufacturers broaden customer-ownership from the moment of sale to the entire ownership period. Various techniques are used to maintain *customer ownership*. A classic example is the *lock-in* of a customer by the automatic referral of the OBU to the automotive OEM. More concretely, upon a pending oil change or when a breakdown occurs, the in-vehicle computer will recommend car manufacturer related services. This exemplary lock-in of value-added services on the OEM-level has to be carefully considered when deploying eCall in an aftermarket scenario.

The provisioning of an eCall OBU can be assessed on both ends of the service provisioning. On the vehicle level, an *OBU manufacturer* will create an embedded device for new cars and a nomadic device for aftermarket implementation. A nomadic device is accepted by the European Commission (EC) because of the business opportunities with mobile services.[10] A personal nomadic device could establish connectivity with an embedded module through Bluetooth. For safety and reliability reasons, a nomadic device is recommended by the EC. A GSM module with SIM should provide voice and data connectivity.

We also make note of the OBU manufacturer at the other end of the service provisioning chain, the second level users. Different private companies can provide different OBU's for emergency vehicles.

A *Mobile Network Operator* (MNO) will provide the voice and data connectivity throughout the service provisioning (cfr. figure 1). European legislation[1] stipulates that upon an eCall trigger, every operator should make his network available to assure connectivity. However, connectivity with a filtering instance will not be without expenditure.

A vital service within the implementation of the automated eCall system is the filtering of emergency calls, by a *first level PSAP*. A private company should take up the role of filtering false calls to counter a possible overload of the emergency call centre. The GM OnStar case in the USA confirms the need for this service as statistics convey 95% of incoming calls not relating to a primary case of emergency.

[1] Public and private hospitals are seen as second level users, but can also resort under a public-private division.

The service of call filtering is only one of the possible Value Added Services to the deployment of eCall. Other services can be provisioned in combination with the eCall functionality. These *Service Providers* can be insurance companies, car manufacturers or road operators, for instance upon a breakdown call (bCall).

The *System Integrator* is the link between eCall and other Intelligent Transport Systems (ITS) services. When standardising eCall functionality, especially in an embedded automotive device, cross-service communication, interoperability and maybe even integration should be guaranteed between for example road tolling functionality and eCall. The System Integrator will collect all possible customer data (in casu eCall customer data and eCall case data) and make it available for relevant instances.

3. Public sector point of view

A third categorisation concerns the public point of view. Both on the national and European level, legislative initiatives can be detected. First of all, merely the existence of the MoU influences and even directs and possibly regulates the national deployment of eCall. Secondly, on the national level, a role can be attributed to the government to facilitate and accelerate eCall implementation. Since investments should be made to upgrade the PSAP architecture, financial stimuli could precipitate private investments to assure a faster return on investment (ROI) and therefore a higher willingness to invest.

Because the implementation of the eCall black box is optional and the European Union has trouble enforcing the compulsory legislation across the member states, car manufacturers have not yet made the capital expenditure (CAPEX) to install this technology. The concern of car manufacturers to make this CAPEX of approximately 100 Euro per black box can be countered by the fact that this cost will be reallocated to the consumer. However, it might be more important for car manufacturers to see the long-term customer lock-in, as the implementation of the eCall black box will precipitate an overall telematics boost. The growing demand for machine-to-machine (M2M) in-car services reinforces the business case for telecom operators and OEM car manufacturers as the wirelessly connected vehicle opens market opportunities for additional telematics services. The attribution of the eCall black box to a multi-applications platform can provide a valuable on-board connectivity platform for intelligent transport systems.

4. Hybrid model

The Belgian case tends to be a hybrid model because since the elaboration of a Public-Private Partnership (PPP) and representation of the interests of all stakeholders appears to be the most logical way forward. This hybrid model is used as a theoretical framework and adapted to the Belgian case to define possible business scenarios.

D. Categorisation of consequences

Four different consequences are taken into account upon implementation of the Belgian eCall system: the allocation of responsibility, the allocation of cost, the allocation of value-added service and the perception of value added service.

1. Allocation of responsibility

This criterion addresses the question who is held accountable for a substantial part of the eCall service. Different responsibilities are taken into account encompassing network connectivity, software maintenance, hardware operation and service delivery. Although the different business actors involved could objectively know which actors are responsible for what aspect, how the allocation of responsibility is perceived by the end-user can be unexpected, and depends on who is perceived by the end-user to provide what value (cfr. II.D.4).

2. Allocation of costs

Different costs are attributed in the end-to-end service delivery between car manufacturer, road operator, end user, service provider and mobile network operator.

3. *Allocation of value(-added) service*

In terms of value capturing, additional services onto the eCall functionality reveal the main interest of private stakeholders. These business opportunities are entitled as *multi-service provisioning*.

4. *Perception of value-added service*

The end user is identified as a critical actor in the eCall ecosystem because his willingness to pay for value-added services (VAS) like bCall and additional traffic information. Critical to a user is the reliability and the overall quality of service. His perception of VAS is essential when eCall is deployed. A customer is only willing to pay for a service when he trusts the market player and believes the platform provides a high-quality service. This is one of the reasons why a *freemium-model* could be a successful implementation strategy. The freemium strategy implies the cost-free use of a (part of a) service (for a limited period of time). This model tends to achieve a large pool of customers and consequently charge for the service when the customer is convinced of the product value.

III. BELGIAN ECALL IMPLEMENTATION SCENARIOS

The hybrid model, combining the user's, private and public scope, is used as a theoretical framework and adapted to the Belgian case to define possible scenarios. Four different consequences are taken into account upon implementation of the Belgian eCall system: the allocation of responsibility, the allocation of cost, the allocation of value-added service and the perception of value added service.

A. *Theoretical framework*

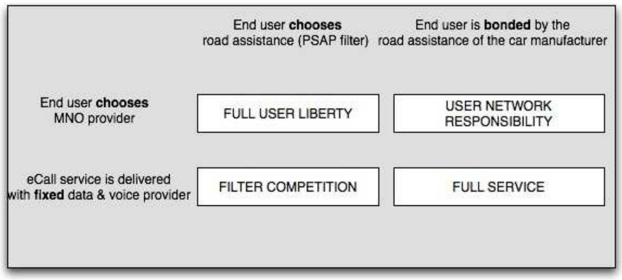

Figure 3: eCall implementation scenarios in Belgium

These theoretical implementation scenarios of eCall in Belgium are based on the hybrid model of actor categorisation with respect of the consequences for responsibilities, costs and value-added services.

B. *Implementation scenarios*

Combination of the four viewpoints (II.C) and four consequences (II.D) result in a matrix of four hybrid scenarios. These scenarios emerge when applying two dimensions describing the degree of freedom of choice that is given to the end-user. The first dimension is whether the end-user is free to pick a road assistance provider of his choice; the second dimension is whether the choice of a network connectivity provider is left to the end-user. Four perspectives emerge when contrasting these two degrees of freedom.

1. *Full user liberty*

The first option depicts the scenario of *full user liberty* where the customer is free in his choice of road assistance, call filtering instance and mobile network provider (MNO). The customer triggers the emergency call automatically or manually and is connected to the public PSAP through his own MNO. The user is responsible for all costs of value-added services (VAS), but disposes of complete liberty and control in his choice of service packages. In this scenario customer ownership involves competition on both the service provider level and the MNO level. Free market play should result in optimal price setting and Business-to-Consumer (B2C) opportunities.

2. Network liberty

In the *network-free scenario* a car manufacturer sells a car with an embedded eCall system, but leaves the choice of the MNO to the user. All connectivity needed for VAS depends on a private subscription to a MNO of the user's choice. All (roaming) costs for value-added mobility services like traffic information and breakdown call are allocated to the user, but he is bound by the road assistance of the car manufacturer. These Business-to-Business (B2B) agreements between public (PSAP) and private (MNO, filtering instance, service provider and car manufacturer) parties confirm the hybrid constellation. The customer perceives all VAS to be allocated to the car manufacturer.

3. Filter competition

A scenario of *filter competition* omits the user in his choice of service providers, but this service is delivered with a fixed MNO. Service-level agreements between the service provider and MNO result in a scenario where operators tend to leave the struggle for customer ownership to the service providers. Connectivity costs for VAS are included in bundled packages resulting in a direct B2C relationship between the service provider and customer. Users perceive the VAS to be attributed to the service provider.

4. Full service

A fourth and last scenario describes the option of *full service*, where a customer buys an integrated eCall system on an OBU equipped with a virtual platform. This platform allows the installation of various service applications, guaranteeing interoperability and multi-SIM connectivity.

C. Market scenarios

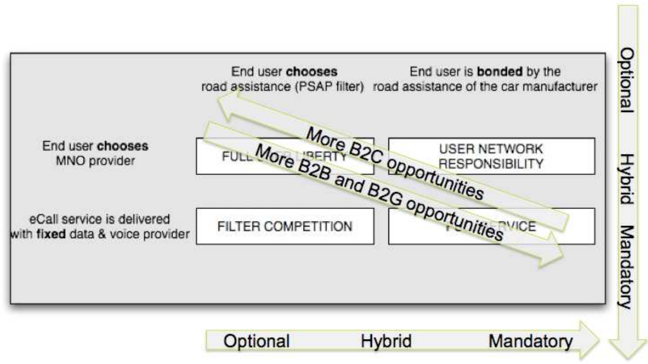

Figure 4: Customer ownership and market opportunities

Figure 4 pinpoints customer ownership and market opportunities in the four described scenarios. Horizontally and vertically the degree of freedom ranges from optional over hybrid to mandatory, where optional positions the viewpoint of a private pull and mandatory indicates the public push.

As the graph leans towards a mandatory scenario as well on the horizontal as well as on the vertical level, more business-to-business (B2B) and business-to-government (B2G) opportunities are disclosed. A full service scenario implies a back-end array of business agreements between companies and between companies and governments. Within this value network, customer ownership is conceived to be located only to the car manufacturer delivering eCall and additional functionalities, inclusive on-road service subscriptions.

Reversed impetus towards a higher degree of user freedom displays more business-to-consumer (B2C) opportunities. The struggle for customer ownership will take place on various levels of the value network.

IV. BUSINESS CASE

Assessing the business case for the Belgian case, drawing on a hybrid scenario, discloses a comparatively weak private pull, opposing a strong public push.

A. Private pull impetus

Existing ITS technologies are mainly proprietary to car manufacturers. Implementation of an eCall service onto current branded ITS services may lead to standardisation issues. Car manufacturers have lesser tendency to implement eCall functionality for reasons of weakly monetised benefits. In their opinion, it is the responsibility of the local and European executive to look after the safety of the road users.[11]

The return on investment of on-board eCall can however be monetised by private road assistance companies.

B. Public push

Different factors supplicate and confirm a public push to a pan-European deployment of eCall. Optimised mobility, improved safety, infrastructure efficiency and environment sustainability are the main policy objectives. These strong societal benefits legitimate and even compel authorities to the local deployment of eCall.

V. CONCLUSIONS AND SUMMARY RECOMMENDATIONS

Given the different insights of multiple players on a Business-to-Business (B2B) level, several issues surround the monetisation of this service. Industry-level take-up of this service has been hampered by a weak business case, although the service implies a wide array of societal benefits such as improved safety, optimised mobility, infrastructure efficiency and energy/environment sustainability. Considering the weak private business case but strong public business case, a governmental stimulus appears to be desirable, in order to stimulate a market-wide introduction. By combining a business modelling methodology founded on degrees of end-user freedom, this paper gives a detailed overview of the different motives of industrial and governmental actors, and the trade-off between monetised and societal benefits. The current market situation reveals private interest in eCall services, but a lack of national stimuli to endorse the MoU. Deployment of a mandatory and automated eCall combined with sufficient degrees of freedom to build additional services on top of a basic platform can result in supplementary services offered by some car manufacturers. Policy impact assessment through monetisation of societal benefits could precipitate governmental investments and trigger a transnational awareness of and allegiance to road safety through an obligatory eCall system with equal customer access to this life-saving service.

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