EAST WEST TRANSPORT CORRIDOR

REPORT

Integration of added value services with distance based road user charges

East West Transport Corridor

Development and Growth through Intelligent Transport Solutions

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Executive Summary

Background

Transport in the East West direction in the Baltic Sea Region is growing and transport volumes are expected to increase in the future. The East West Transport Corridor project aims at strengthening the corridor by developing an overall strategy for infrastructure improvements and new solutions for business and logistics. This report address the prospect for using intelligent transportation systems (ITS) as a tool for innovative actions in the corridor, by using a foreseen kilometre tax system as a platform for added value ITS services (AVS).

Candidate added value services

Candidate AVS systems are found amongst ITS applications that have reached a certain level of maturity. We also have to distinguish between public and commercial services, taking into account the conditions for providing the service. The most important candidates are:

Public Services

- Intelligent Speed Adaptation (Speed Alert)
- Alcolock
- Data collection for traffic management (road status monitoring)
- Hazardous Goods Monitoring
- eCall
- Traffic Information Services
- Preferred network guidance

Commercial Services

- Vehicle and cargo information (for the haulier and consigner)
- Driver support systems
- Payment of transport services

Conditions for added value services

The viability and feasibility of AVS depend on several criteria and conditions:

Technical preconditions

The implementation of a kilometre tax system will include vehicle equipment that register a vehicle's route (continuous time and place) and transfer this information to the roadside. This vehicle equipment consists of a positioning device (e.g. GPS), processor capacity, memory and a communication channel (e.g. CN). An AVS that requires technical equipment above what is provided by the electronic road fee (EFC) application is less feasible (e.g. eCall requiring a crash sensor). Also, it is fundamental that the AVS application is not in conflict with the security requirements of the EFC application.

Thin or heavy client OBU for EFC

A thin client on board unit (OBU) does not contain road network characteristics. This means that ITS applications using such characteristics (e.g. ISA) are less viable as AVS.

Supporting transport policies

There are of course problems associated with "mixing applications" of different nature. It is not evident that tax collection should share costs with infotainment

applications etc. Hence we can expect that applications directly supporting public transport policies are likely more suitable to provide together with a kilometre tax.

Competitive environment for the AVS

Added Value Services that are provided through the OBU for kilometre tax will most likely not be successful if the quality of the service provided is considerably lower than when the service is provided by dedicated equipment. A good example is route information, where a dedicated navigation system likely is far better.

Recommendations

When implementing an added value service with an application used for distance based charging, it is vital to ensure that the AVS is not in conflict with the policy behind the user charge. Considering the preconditions that apply, the following AVS applications have been found to be the most promising:

Recommendations for a thin client On Board Unit

- Collection of road and traffic data (travel times, road surface conditions etc.)
- Monitoring Hazardous Goods Transport
- Transport service payment
- Cargo tracking & tracing (vehicle following)

Recommendations for a heavy client On Board Unit

In addition to the AVS recommended for a thin client:

- Speed Alert (intelligent speed adaptation - ISA)
- Preferred Network Guidance
- Real time traffic information (but other information channels probably more suitable and efficient)

Table of Contents

1	The East-West Trans-national Corridor	6
1.1	Background	6
1.2	This report	7
2	Classification and overview of value added services	7
2.1	Public services	7
2.2	Commercial telematics services	9
3	Existing technologies	10
3.1	Information systems in vehicle	10
3.2	Satellite positioning	10
3.3	Mobile communication	11
3.4	Short distance communication	12
4	Conditions for added value services	12
4.1	Technical preconditions	12
4.2	Supporting transport policies	13
4.3	Competitive environment for the AVS	13
4.4	Thin or heavy client OBU	13
5	Services analysis	14
5.1	Public services analysis catalogue	15
5.2	Commercial services analysis catalogue	16
6	Conclusion	18
6.1	Requirements for viability	18
6.2	Global recommendations	19
6.3	Recommendation for an East-West demonstrator	19
7	References	20
7.1	Written material	20
7.2	Internet links	20

1 The East West Transport Corridor

The transport corridor from Esbjerg in Denmark to Klaipeida in Lithuania via southern Sweden is an important link between East and West in the Baltic Sea Region. Commercial actors, authorities and universities have taken a joint initiative to strengthen the corridor and formed the East West Transport Corridor project within the Interreg III programme.

Transport in the East West direction in the Baltic Sea Region is growing and transport volumes are expected to increase in the future. However, there are transport problems along the corridor that hamper the development. This project will strengthen the corridor by developing an overall strategy for infrastructure improvements and new solutions for business and logistics. The project is divided into five work packages. This report, Integration of value added services with distance based charging, is performed within WP2 - ITS as a tool for innovative actions in the corridor.

1.1 Background

A new road user charging system for heavy good vehicles (HGV) is expected to replace the current flat fee Eurovinjett (a.k.a. Eurovignette) system in Sweden in the future. According to the Swedish Governmental Commission on Road Taxes the proposed system is distance based (a "kilometre tax") covering all public roads and all HGVs with a maximum laden weight exceeding 3,5 tons are subject to a tax which shall reflect the marginal cost principle.

The implementation of a tax system will include vehicle equipment that register a vehicle's route (continuous time and place) and transfer this information to the roadside. This vehicle equipment (On Board Unit – OBU) for electronic fee collection (EFC) consists of a positioning device (e.g. GPS), processor capacity, memory and a communication channel (e.g. CN), and may have a great impact on the road carrier industry enabling new services covering both public, industrial and private interests.

By combining the application for road tax charging with other applications providing value added services, several benefits appear. E.g. value added services can support increased user acceptance for the distance based tax and the equipment and operational costs can be divided among several services and thus making them more cost effective.

There are however problems associated with "mixing applications" of different nature. It is not evident that tax collection should share costs with infotainment applications…

The development of value added services should therefore be performed with respect to different perspectives:

- The government perspective is to support transport policy goals.

- The road users' perspectives are efficiency and safety.

- The industrial perspective is to build effective logistics systems.

Hence new services must be developed with regard to the environment they are to be implemented in such as limitations due to system security requirements, legislation and interoperability.

The implementation of a distance based tax system in Sweden is not yet finally decided and it would be unwise to define detailed technical characteristics today since much will change (like the full introduction of 3G cellular networks and the establishment of the Galileo system). Furthermore, some

European states (such as Germany, Austria, and Switzerland) have introduced different EFC solutions which are not interoperable. To support interoperability between member states and the principle of free movement of people and goods the EU has specified satellite navigation, cellular networks and dedicated short range communication (DSRC) to be used in EFC systems. This is specified in directive 2004/52/CE with the ambition to create a European Electronic Transport Service (EETS) and work is currently ongoing.

1.2 This report

The objective of this report is to recommend value added services which can be integrated in an OBU used for distance based EFC system in operation, and possibly for a future demonstrator within the East West TC project. The method applied is a three-step approach: First we identify candidate value added services (chapter 2). Secondly we analyse the technical conditions that follow from interoperable EFC (chapter 3), and thirdly we map our candidate services against technical prerequisites (chapter 5) to identify prospect combinations in general and a demonstrator in particular.

2 Classification and overview of value added services

On a high level, value added services that are provided in combination with an EFC application, are found within Intelligent Transport Systems and should meet the following requirements:

- They are of interest for many stakeholders.
- They may share part of EFC investment costs, but only to a limited extent.
- They aim at increasing support for the EFC application,.or support other public transport policies.
- They should also be already existing ITS services.

The services of interest are divided into public and commercial telematic services. Public services are associated with public policy goals such as to improve traffic safety, support the marginal cost principle, traffic management and information to travellers or compliance services such as the Alcolock or Speed Alert. Commercial telematics services are developed by the industry and are used to increase benefits and optimise routes etc.

Candidates for these two types of services are discussed in the following.

2.1 Public services

2.1.1 Speed Alert (ISA)

Speed Alert provides a driver with current speed limit information and warns the driver when exceeding that limit. A warning can be passive (audio signal or a message on OBU display) or active (e.g. activating a resistance in the gas pedal). An electronic device is fitted in the vehicle, and the driver can change some parameters in a menu system allowing for a more flexible use. When Speed Alert has reached a widespread use it will greatly contribute to and support increased traffic safety and intelligent transport movements.

2.1.2 Hazardous Goods Monitoring

Movements of Hazardous Goods Transport are monitored by Traffic management / Traffic Information centres for several reasons. In case of accidents, it is of

particular importance for the rescue service to gain early knowledge of the type of goods carried in order to trigger the appropriate measures. Also, transport of hazardous goods may need alert information and guidance to avoid parts of the road network where access is prohibited (tunnels, bridges, city centres etc) or where the risk of a road accident is bigger.

2.1.3 Preferred Network Guidance

Preferred Network Guidance aims at giving the driver information and recommendations concerning route selection. It may function in combination with a pricing mechanism that supports/stimulates the use of higher class roads designed to carry the load from heavy trucks. In e.g. Southern Sweden, the Road Administration has identified the specific set of roads that are considered as preferred for use by HGVs.

2.1.4 Alcolock

Alcolock (alcohol ignition interlock breath device) is a breath testing device connected to the ignition system of a motor vehicle. It prevents an operator from starting the vehicle if the breath alcohol concentration (BrAC) exceeds the drink-driving limit by activating a lock. The alcolock is embedded in a monitoring program and sometimes complemented with medical interventions. A data recorder is necessary to recognise and inform the programme monitors on tampering and bypass attempts. Two technologies are used: semiconductor technology and electrochemical sensing technology (fuel cell). Most models are based on semiconductor technology.

Alcolock is an alternative to an unconditional driving ban and is targeted at persistent drink-driving offenders. This means a right to drive under the supervision of the on board unit. The Guardian Interlock WR2 is the only device that meets the requirements defined by the Swedish Road Administration in Sweden.

2.1.5 Road status monitoring

Road status monitoring is about information collected by mobile units and communicated to a traffic management central to be used for various applications and services. Information such as travel times, mean speed, road conditions (rain, slippery road etc.), traffic velocity etc. can be collected by the on-board units and sent to the traffic management centre. Such information may be uploaded by an OBU to a roadside entity and the process may be fully automatic with no action required from the driver. The information collected is essential for strategic planning and traffic management services like traveller information.

2.1.6 Traveller information

Traveller information is provided by e.g. traffic management centres and includes traffic information to a traveller such as congestion warnings, accessibility, incidents, travel times etc. Traffic information is an effective tool for traffic management in order to minimise external marginal costs by enabling the driver to make intelligent travel decisions and avoid difficult situations. Such information requires to be communicated to the driver through the OBU from a road side entity in order to present the information visually or audibly to the driver. This enables a high degree of service level to be offered to the driver by using a more complex and expensive OBU.

2.1.7 eCall

eCall is a service which automatically alerts rescue services in case of an accident or an emergency situation. The vehicle will automatically dial 112 to the nearest rescue

centre but can also be activated manually and transmit vehicle data and position. Information relevant to the rescue team can be displayed prior to the arrival at the incident location. Access to information such as the exact position of the vehicle reduces the time to rescue, and information such as type of goods, number of passengers etc. is displayed so the team is correctly equipped in advance.

2.2 Commercial telematics services

Commercial telematics services can roughly be divided into five sub-groups; security, vehicle maintenance, navigation and accessibility, productivity, and entertainment.

There are several commercial telematics services available on the market. They have here been divided into the following categories considering the above sub-groups.

2.2.1 Road haulers management services

Transport management includes services used to plan and perform transport assignments, reduce time for administrative processes, and positioning and route planning supports the processes:

- Automated driver logs (time reporting and idle times).
- Order support – application supporting when a driver communicate information to back office or vice versa.
- Positioning – reveals vehicles position with no interaction from the driver.
- Route planning and re-routing.
- Messaging – Back office can contact a specific vehicle or a number of vehicles.

2.2.2 Vehicle (cargo) follow-up services

These services provide vehicle and cargo data in order to secure and maintain goods, vehicles and the driver.

- Vehicle data - temperature, tires, engine and weight.
- Trip report - follow-up fuel consumption and service intervals.
- Zone alarm - geographic boundary with automated alerts.
- Tracking and tracing of goods in case of emergency.
- Vehicle alarm – sends an alarm to e.g. mobile phone with vehicle position when theft alarm activated.

2.2.3 Driver support services

Driver aid and entertainment supports the driver to e.g. drive more efficiently and thus decrease fuel consumption and reduce pollution. Examples include::

- Camera - when reversing and viewing of dead angles.
- Eco driving - eco-driving improves road safety as well as the quality of the local / global environment, saves fuel and costs.
- Music, TV and games – entertainment when vehicle is standing still.
- Navigation – voice navigation and supports route planning.

- Moving map - map with vehicles current position and other objects such as workshops etc can be marked.

- Telephone – mobile hands free telephone with large digits.

2.2.4 Payment for transport services (parking, tolls, ferries, etc.)

Payment for other transport services is an obvious add-on to a kilometre tax application. Parking payment is an often used service integrated with OBU for road charges, and we can se that a CN/GNSS system may find its use for on-street parking payment where the positioning capability can be used. Also road toll payment (other installations and services) and payment for ferry transport are easy to combine with a road user charge, these being based on an entry – exit concept and suitable for DSRC.

3 Existing technologies

To calculate a distance based road tax, it is fundamental to continuously register a vehicle's trajectory – its position at specific times. The specific calculation can either be done inside the vehicle or in central systems, whereas the trajectories need to be transferred to a road side systems. Regarsless, the in-vehicle telematics platform required for this enables integration of value added services. However, the services must be developed in harmony with existing systems and not interfere with or enable manipulation with the road user charge application. Therefore, some general criterion must be applied on the services and the basic existing standards and techniques used.

3.1 Information systems in vehicle

The Controller Area Network (CAN) bus protocol is a mature ISO standard for data communication within vehicles. The protocol was developed aimed at automotive applications such as extracting vehicle information from the vehicle such as speed, friction, fuel consumption, temperature etc. and to use for control purposes (e.g. ABS brakes) but has now reached a more widespread use.

The Media Oriented Systems Transport (MOST) specification is an auto industry standard for building in-vehicle multimedia systems. It differs from existing technologies in that it provides a networking system at bit-rates far higher than available on previous technologies.

3.2 Satellite positioning

Satellite positioning is expected to be intensively used in distance based road charging system in the future. The advantage with satellite positioning is to acquire rather accurate positioning information all around the world without providing any infrastructure, except a receiver, on the ground. The disadvantages are poor coverage in urban areas and the risk of manipulated data.

GPS

Navstar Global Positioning System is run by the US air force and has been operative since 1995. The SA signal was switched off in year 2000 and the accuracy is now +/- 20 m. GPS needs 24 satellites for global coverage but it often has more since old ones are replaced with new before the old ones are decommissioned.

GLONASS

GLONASS is run by the Russian air force and like GPS needs 24 satellites in orbit for full national coverage. Today only 14 satellites are in orbit and 12 fully functional.

GALILEO

GALILEO will be run by European Community in cooperation with the European Space Agency (ESA). 30 satellites will be used and the complete system will be in operation around 2011. The advantage with GALILEO is better reliability and precision in urban areas. A receiver using the free public service is +/-15 m and a receiver that can interpret both GPS and GALILEO signals has a position accuracy of 4-8 metes. A paid service will increase the accuracy to +/- 1 meter .

Protocol for GPS positioning

NMEA is a standard protocol for GPS receivers with messages including position, velocity and time and provides quite a range of other sentences. The receivers also have a binary mode for those applications requiring position updates of greater than once per second.

3.3 Mobile communication

Global System for Mobile Communications (GSM)

GSM is the dominating standard in Europe but the capacity is limited due to low transmission rate (approximately 14,4 kbps) and GSM is sessions based (a conversation must begin before data can be transferred). GSM is also sensitive to disturbances and lost connections, due to lack of coverage, this often means that a data transfer must be completely redone.

Short Message Service (SMS)

Using SMS to transfer data is expensive and has a reduced transmission capacity (maximum 160 characters). The advantage is the stabile operation of the service and messages are stored on a central server before being downloaded.

General Packet Radio Service (GPRS)

GPRS is the third generation standard for mobile telephones and developed for faster data transmissions. GPRS also requires a connection before data transfer is possible and the transfer rate is 28,8 kpbs for download and 9,6 kpbs for upload. All known operators charge based on the amount of transferred data.

Universal Mobile Telecommunications System (UMTS)

UMTS is the third generation standard for mobile telephones in Europe and Japan and has a transfer rate of 1920 kbps. UMTS is not interoperable with GSM but usually newer 3G phones are equipped with a device enabling an automatic switch if the UMTS-connection is lost (quad-band).

Protocol for communication

Global Automotive Telematics Standard, GATS, has been developed by Vodafone as a communication protocol via GSM and Motorola has a similar standard called ACP. The combination of the protocols is a standard called Global Telematics Protocol (GTP). The ambition is that OSGi platform for applications on OBU and GAT as a protocol for a number of predefined services such as track and trace.

OSGI

The OSGi Alliance (formerly known as the Open Services Gateway initiative) is an open standards organization and defines the OSGI technology for networked

services. The major companies of the OSGi Alliance are Sun Microsystems, IBM, Ericsson. Over the past few years it has specified a Java-based service platform that can be remotely managed. Based on this component oriented framework, a large number of OSGi Services have been defined such as fleet management.

Protocol Machine to Machine

Electronic Data Interchange (EDI) is a computer-to-computer exchange of structured information by message standards for the transfer of business transaction data. One typical application is the automated purchase of goods and services.

3.4 Short distance communication

Short distance communication can be used to transfer large amount of information such as WLAN or small and simple messages such as RFID or DSRC.

Radio Frequency Identification (RFID) and Dedicated Short Range Communication (DSRC) by microwave

RFID is a radiofrequency technique with less functionality where a vehicle transponder is detected by a road side receiver. The technique is very similar to the DSRC technique which uses the frequency between 5,8 and 5,9 GHz. The technique is only suitable for exchange of information with vehicles on a certain spot. RFID and DSRC can transfer information to and from a vehicle in motion at a very high data rate.

Infra red (IR)

Infra red uses high frequency radiation to transfer data, roughly between 300-400 THz. The Infrared Data Association (IrDA) has developed a series of standards for IR. The DSRC protocol also covers the use of IR communication. Similar to RFID, IR is used for spot-based communication between the vehicle and the roadside systems, but is applicable at longer distance than microwave.

Wireless Local Area Networks (WLAN)

WLAN is a computer network and is a radio frequency (2,4 and 5 GHz) technique to connect to the Internet. The dominating standard is the IEEE 802.11 series. The range is about 100 meters, but the technique is not suitable for communication to and from a vehicle in motion.

Bluetooth

Bluetooth is a communication standard and uses radio frequency at 2.45 GHz. The hardware is cheap and not affected to disturbances due to a special technique and range is 10 meters and more. Bluetooth is not suitable for communication to a vehicle in motion.

4 Conditions for added value services

The viability and feasibility of AVS depends on several criteria and conditions.

4.1 Technical preconditions

The implementation of a kilometre tax system will include vehicle equipment that register a vehicle's route (continuous time and place) and transfer this information to the roadside. This vehicle equipment consists of a positioning device (e.g. GPS), processor capacity, memory and a communication channel (e.g. CN). An AVS that requires technical equipment above what is provided by the EFC application is less feasible (e.g. eCall requiring a crash sensor). Also, it is fundamental that the AVS application is not in conflict with the

security requirements of the EFC application.

A particular aspect of the technical preconditions is the thin or heavy client OBU issue. This is elaborated upon more in detail below.

4.2 Supporting transport policies

There are of course problems associated with "mixing applications" of different nature. It is not evident that tax collection should share costs with infotainment applications etc. Hence we can expect that applications directly supporting public transport policies are likely more suitable to provide together with a kilometre tax.

4.3 Competitive environment for the AVS

Added Value Services that are provided through the OBU for kilometre tax will most likely not be successful if the quality of the service provided is considerably lower than when the service is provided by dedicated equipment. A good example is route information, where a dedicated navigation system likely is far better.

4.4 Thin or heavy client OBU

A critical issue when developing a distance based road charging system is where the functionality shall reside. Should the major functionality be allocated in the OBU (heavy client OBU) or should it reside in a central system on the roadside (thin client OBU)?

It must be stressed that it is the functionality that decides whether the client is "thin" or "heavy". Processor and memory capacity, user interface capacity etc. do not decide whether a client is thin or heavy, but as a heavy client needs more capacity there is normally a correlation between "much capacity and heavy client" and "less capacity and thin client".

Thus, the major difference between the thin and heavy clients is the functionality.

4.4.1 Thin client

A thin client for distance based EFC is an electronic device where only basic vehicle and trip data is registered on-board, and the information is then communicated to a roadside entity or central system for further processing.

4.4.2 Heavy client

The heavy client is a more complex device where much of the processing of the trip data is carried out inside the on-board unit. This means that the on-board unit needs more processing capacity, but also more background information for the processing. Typically in EFC, the heavy client carries the map-matching function and the tariff instructions on-board enabling the road user charge to be calculated on-board the vehicle.

4.4.3 General differences between thin and heavy client

Display information

The heavy client has a more obvious need for an interface to display information to the driver while the thin client has less need for user interface and display possibilities.

Communication

We can expect a thin and a heavy client for distance based EFC to require similar communication capabilities.

Value added services towards the user

The heavy client offers more obviously the processing capacity and user interfaces

required to enable added value services oriented towards the driver.

Monitoring capacity

We can expect the thin and heavy client to be fairly equal in their capacity of providing (uploading) basic information for traffic management purposes.

Installation

We can expect a thin and a heavy client for distance based EFC to require similar installation procedures.

Costs

A heavy client is likely more expensive to purchase compared to a thin client since a heavy client includes more features, technology and functionality

Complexity

A heavy client is a slightly more complex device, due to its need for more capacity. However, the applications residing in the heavy client indicate a system with much higher complexity since all information required for fee calculation has to be downloaded into the OBU by the communication interface.

Robustness

Since the heavy client most likely have a more extensive capacity and functionality, it is likely less robust than a thin client. On the other hand, modifications to a thin client are more difficult to make if needed.

To summarize: A thin client is as good as the heavy client at collecting and communicating data to roadside systems, but less good at processing data and present information to the driver.

5 Services analysis

Each value added service is described regarding required functionality and technology. The service is assessed as to whether the required technique comply with the EFC directive (2004/62/EC), which defines GNSS (Global Satellite Navigations Systems), DSRC (Distance Short Range Communication) and CN mobile communication.

Each service is also assessed regarding if the required functionality is similar to the functionality required for the kilometre tax system as proposed by the Swedish Governmental Commission:

1. Register position – register a positioning signal (time stamped coordinates) and store the positioning information in the OBU.

2. Map matching – match the positioning signal to a road map by a map matching algorithm and determine a performed route. Requires a digital road map in the vehicle.

3. Calculate road charge – calculates the road charge, which requires a price list and relevant vehicle data (weight, engine class etc.) to be available.

4. Processing capacity

5. Long-distance communication to roadside – information from the OBU is communicated to a roadside entity and vice versa through a cellular network.

6. Short-distance communication through DSRC functionality is expected for use in the control system required.

7. Display OBU status information to the driver.

5.1 Public services analysis catalogue

Value added service	Description of service	Required EFC-functionality	Required EFC-technology	Service assessment
Speed Alert	Inform driver of current speed limit and warn driver when exceeding that limit.	Register position, register speed Map matching Communication to road side **Additional functionality:** Warning functionality	**Client:** heavy client + display **Communication:** GSM **Navigation:** GPS	**Functionality:** Requires additional functionality. **Technology:** Requires additional technology.
Alcolock	Prevents a driver from starting the vehicle if driver have drunk more alcohol than the legal limit for driving.	**Additional functionality:** Detection of breath alcohol concentration, lock to vehicle ignition system.	**Client:** Unique client + display. (Alcolock with fuel cell sensor, human breath recognition systems, data recorder.) **Communication:-** **Navigation:** -	**Functionality:** Do not require same functionality. **Technology:** Do not require same technology.
Road status monitoring (upload)	Provide current traffic information and conditions to the road operator	Register position, speed, speed variation, travel times etc Communication to road side **Additional functionality:**	**Client:** Thin client **Communication:** GSM, DSRC. **Navigation:** GPS	**Functionality:** Requires same functionality. **Technology:** Requires same technology.
Preferred Network Guidance	Advice the driver on route selection	Register position Map matching Communication to road side **Additional functionality:**	**Client:** heavy client + display **Communication:** GSM **Navigation:** GPS	**Functionality:** Requires additional functionality. **Technology:** Requires same technology.
Hazardous Goods Monitoring	Allow the Traffic management Centre to follow Haz Goods transport	Vehicle data, register position Communication to road side **Additional**	**Client:** Thin client **Communication:** GSM **Navigation:** GPS	**Functionality:** Requires same functionality. **Technology:** Requires same

		functionality:		technology.
Traveller information (download)	Provide driver with current traffic information and guidance	Register position Map matching Communication to road side **Additional functionality:**	**Client:** Heavy client + display **Communication:** GSM, GPRS DSRC. **Navigation:** GPS	**Functionality:** Requires additional functionality. **Technology:** Requires same technology.
e-Call	Automatic alarm in case of accident	Register position Communication to road side **Additional functionality:** Crash sensor data	**Client:** Thin client **Communication:** GSM **Navigation:** GPS	**Functionality:** Requires additional functionality. **Technology:** Requires additional technology.

5.2 Commercial services analysis catalogue

Transport Services payment	Use the EFC OBU for payment	Vehicle data, Register position Communication to road side. **Additional functionality:**	**Client:** Thin client + display **Communication:** GSM, DSRC. **Navigation:** GPS	**Functionality:** Requires same functionality. **Technology:** Requires same technology.
Transport manage-ment services 1) Automated driver logs, order support and economy systems. 2) Positioning and route planning.	Services used to plan and optimise transports and support administrative processes for road haulers.	1) Communication to road side. 2) Register position Map matching Communication to road side. **Additional functionality:** Visualisation of current position Navigation	1) **Client:** Thin client + display **Communication:** GSM, GPRS **Navigation:** GPS 2) **Client:** Heavy client + display **Communication:** GSM, GPRS **Navigation:** GPS	1) **Functionality:** Requires same functionality. **Technology:** Requires same technology. 2) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology.

Vehicle follow-up services 1) Vehicle data, trip report 2) Track and trace of goods	Provide vehicle data, alarm when entering / exiting geographic boundaries and provides position of goods.	1) Register position Map matching Communication to road side **Additional functionality:** Detection of vehicle status Register vehicle data 2) Register position Communication to road side **Additional functionality:**	1) **Client:** Heavy client + display **Communication:** GSM, GPRS **Navigation:** GPS 2) **Client:** Thin client **Communication:** GSM, GPRS **Navigation:** GPS	1) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology. 2) **Functionality:** Requires same functionality. **Technology:** Requires same technology.
Driver support services 1) Eco driving 2) Camera 3) Navigation 4) Music, TV, games	Supports the driver with administrative processes, provides entertainment and supports driver while parking and driving.	1) Provide special Eco driving information. 2) Provide parking information 3) Register position Map matching Communication to road side **Additional functionality:** Visualise current position. 4) Special functionality.	1) **Client:** Heavy client + display, **Communication:-** **Navigation: -** 2) **Client:** Heavy client + display, **Communication:-** **Navigation:** - 3) **Components:** Heavy client+ display **Communication:** GSM, DSRC **Navigation:** GPS 4) **Components:** Special client + display **Communication:** GSM, GPRS **Navigation:** -	1) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology. 2) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology. 3) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology.

				4) **Functionality:** Requires additional functionality. **Technology:** Requires additional technology.

6 Conclusion

6.1 Requirements for viability

When implementing a value added service with an application used for distance based charging it is vital to establish the purpose. Is the purpose to increase traffic safety? Should it reflect the marginal cost principle, provide with traffic information etc.? The choice is fundamental to consider before choosing an appropriate value added service.

It may prove to be a challenge to integrate an application used for EFC with value added services. It is e.g. forbidden to integrate value added services with the OBU used in the German Toll Collect system.

However, when the purpose is established the following questions need to be resolved:

- The value added service should use the same technology as described in the EFC directive.

- The value added service should use similar functionality as is used in a distance based charging system.

- Should the value added service be a payment or information service?

- Should the service require upload or download information to the OBU? Upload services are of limited value to the driver but provide relevant traffic data to the authorities.

- Should the value added service be a public or commercial telematic service?

- Should the value added service be based on user needs or on public perspective?

The development of value added services should therefore be performed with respect to the different perspectives:

- The government perspective is to strengthen the effects such as the marginal costs principle.

- Road carriers' perspective is to maximise the benefits.

- Industries' perspective is to build effective logistics systems.

New services must be developed with regard to the environment they are to be implemented in such as limitations due to system security requirements, legislation and interoperability.

6.2 Global recommendations

As can be seen from the analysis table, the following added value services seems possible to implement in a thin client environment with limited additional system complexity:

- Road Status Monitoring (upload)

- Hazardous Goods Monitoring

- Transport Services payment

- Tracking and tracing of cargo

In addition, a heavy client EFC solution offers possibility for also:

- Speed Alert (requires speed data included in map)

- Preferred Network Guidance (requires preferred network included in map)

- Traveller information services

In the last case, ordinary information channels like the radio system seem to be more relevant.

6.3 Recommendation for an East-West demonstrator

The requirements and ambition level should be less compared to a full system in operation. The demonstration is expected to be conducted typically concurrent with the final seminar of the East West Transport Corridor project. The demonstration is to be performed in order to visualise the possibilities of integrating value added services with distance based charging. Hence, the demonstrator should be pedagogic rather than authentic.

Below are some recommendations regarding value added services to be chosen for a demonstrator:

- The value added service should use same technology as described in the EFC directive.

- The value added service should use similar functionality as is used in a distance based charging system.

- The service should not be a new service; it should be an existing service due to the remaining time to demonstration.

- The service should be informative unless an integration of an additional payment service is easy to implement.

- The OBU should be equipped with display for visualisation purposes.

- A heavy client application is easier to demonstrate. A thin client could be virtually without any interface.

Considering these requirements and the analysis made, we propose the following candidates for an East West demonstrator:

- Hazardous Goods Monitoring (requires a road side server application)

- Speed Alert

- Preferred Network Guidance

7 References

7.1 Written material

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7.2 Internet links

http://www.osgi.org/

http://www.commlinx.com.au/NMEA_sentences htm

http://www.alkolas.se/en/products

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