Reduction
2011- 2014

Deliverable D7.2 First periodic report

07-01-2014

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Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) [1]:
  - X has fully achieved its objectives and technical goals for the period;
  - ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations.
  - ☐ has failed to achieve critical objectives and/or is not at all on schedule.
- The public website, if applicable
  - X is up to date
  - ☐ is not up to date
- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: Prof. Dr. Lars Schmidt-Thieme

Date: 29/10/2012

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism.

Executive Summary

This deliverable summarizes the work progress achieved in all work packages by the consortium during the first year of the project (01/09/2011 – 31/08/2012). The goal of this deliverable is to ensure effective planning and monitoring of the tasks and outcomes as well as individual work done in the work packages. On the basis of summaries done for each work package on the progress achieved the REDUCTION consortium can measure the achievement of goals as stated in the grant.

The deliverable also includes a summary of the management activities done during the first year of the project including project meetings, monitoring of timely submission of deliverables and milestones, the progress in updating the project website, dissemination activities and publications as well as quality management.

An important part of this deliverable is the controlling of resources including person months and budget, which is meant to give an overview of resource expenditure. The deliverable also contains an explanation on the use of resources especially with the focus on deviations or budget changes or shifts.

Finally, a risk assessment plan is meant explore potential internal and external risks which may negatively affect the progress of the project.

1. Introduction

1.1 Project Overview

The reduction of CO2 emissions is a great challenge for the transport sector nowadays. Despite recent progress in vehicle manufacturing and fuel technology, still a significant fraction of CO2 emissions in EU cities is resulting from road transport. Therefore, additional innovative technologies are needed to address the challenge of reducing emissions. The REDUCTION project focuses on advanced ICT solutions for managing multi-modal fleets and reducing their environmental footprint. REDUCTION collects historic and real-time data about driving behaviour, routing information, and emissions measurements, that are processed by advanced predictive analytics to enable fleets enhance their current services as follows:

1) Optimising driving behaviour: supporting effective decision making for the enhancement of drivers' education and the formation of effective policies about optimal traffic operations (speeding, braking, etc.), based on the analytical results of the data that associate driving-behaviour patterns with CO2 emissions;

2) Eco-routing: suggesting environmental-friendly routes and allowing multi-modal fleets to reduce their overall mileage automatically; and

3) Support for multi-modality: offering a transparent way to support multiple transport modes and enabling co-modality.

REDUCTION follows an interdisciplinary approach and brings together expertise from several communities. Its innovative, decentralised architecture allows scalability to large fleets by combining both V2V and V2I approaches. Its planned commercial exploitation, based on its proposed cutting edge technology, aims at providing a major breakthrough in the fast growing market of services for "green" fleets in EU and worldwide, and present substantial impact to the challenging environmental goals of EU.

1.2 Objectives of Work Package 7

In WP 7 the management team establishes effective lines of communication and reporting procedures to ensure the adequate planning, implementation and coordination of project activities and an independent continuous assessment of progress for the entire project duration. The management team, assisted by an administrative manager, ensured proper financial management within the consortium and the appropriate communication of related matters to the European Commission. A continuous effort is undertaken by the management team to ensure the timely submission of deliverables, milestones, financial statements and reports.

Monitoring the progress in the project is a second focus of the management team. This is ensured through implementation of quarterly progress reports and the use of a communication platform. The

Quality Management Handbook created by the Administrative Manager defines a set of rules on cooperation, organization and quality management procedures within the project.

Regular General Assembly meetings taking place at least on a biannual rhythm and steering committee meetings done in person or by telephone conference are meant to support the flow of information in the consortium.

A risk management plan is set up in the very beginning of the project by DDE covering both internally and externally induced risks. The risk management plan is constantly updated, e.g. if environmental conditions change such as unforeseen novel developments in fleet management systems. To this end, the plan will cover actions and activities that will enable the consortium to continue its work, e.g. by transferring responsibilities between participants.

1.3 Objectives of Deliverable 7.2

Deliverable 7.2 aims at monitoring the progress of tasks and work done in all work packages during the 1st year of the project. The deliverable also aims at monitoring the expenditure of person months and budget resources during the 1st year of the project. The timely submission of deliverables is also being monitored. Another goal of this deliverable is to establish an overview of all dissemination activities and publications in the reporting period in order to monitor the exploitation of scientific results of the project.

2. Project objectives, work progress and achievements

2.1 WP1 Onboard Technology and Wireless Communication

Summary of WP 1

WP 1 deals with basic communication infrastructure and wireless communication. Its objective is to develop the on-board technology taking also into account the requirement for supporting multi-modal fleets.

Work package objectives for the current reporting period

The activities in WP 1 in the first reporting period included building the basic communication infrastructure and developing the onboard technology. The first step in this work package is to collect requirements on the overall architecture of the onboard technology. Then, an initial architecture for technical component communication, set-up and installation routines of devices is implemented. To do so the following tasks will have to be accomplished:

- The V2V on-board Unit, which is suitable for integrating and managing the data flow on motor or rail vehicles will be modified to suit the needs of the project. This will include integration of technology enhancements and testing of individual technology components, which will be done mainly by the partner DDE.
- VANET packet scheduling /routing. This includes the development of the necessary communication infrastructure and wireless communication / networking protocols. In a second stage, the vehicular network as a Constraint Queuing Network (CQN) will be modelled. Subsequently, the packet scheduling / routing policies with optimal throughput and stability properties will be developed.
- Intelligent V2V and V2I Communication. REDUCTION will also tackle issues in taking advantage of using multiple OBC protocol interfaces to exploit V2V and V2I capabilities at the same time, with the objective to increase communications efficiency and handle the interplay between V2I and V2V data transmission and computation distribution.

Progress towards the objectives and tasks completed

The collection of requirements for the overall architecture and the design of the onboard technology was the focus of WP1 for the period M1-12.

Progress on the V2V On Board Unit

For the development of the V2V on-board Unit the partner Delphi has provided its existing Delphi MyFI Communication & Control Unit (CCU). Based on the requirements provided by the project partners, Delphi has made improvements to the unit in order to suit the goals of the project.

In that scope UHI cooperated with DDE in order to specify and understand the format of the vehicle CAN-Bus messages to be filtered. UHI presented the requirements for the storage of vehicular

messages, mainly velocity, acceleration, throttle measurements, braking and other motion dynamics parameters. Consultancy with DDE was carried to analyse the design of the on-board device architecture, so that it meets the requirements of online communication in order to transmit the stream of data to a centralized processing node and receive the feedback and transmit to the driver. The storage capacity was also consulted such that the device can store historical data on driving behaviour for off-line database processing.

Review on state of the art of CAN-Bus message processing was searched and inspected. Various products that interface and filter the vehicular data were reviewed and the specifications were analysed. In order to decode the CAN-Bus messages, a protocol that deciphers the codes of the messages and the semantics of the data values is required. Such protocols are proprietary documents belonging to the vehicle manufacturers.

UHI in cooperation with DDE and other partners searched various sources on regulations for gathering requirement on preparing a non-disclosure agreement with manufacturers, with aim of sending a legal request to be granted the access to the data protocols. Experts from DDE and Ford research were consulted, and a road map was built on the procedures for preparing the legal request at the beginning of the second year of the project.

The current version of the Delphi MyFI Communication & Control Unit includes the following modifications and improvements:

- improved CPU speed (to 1GHz from 500 MHz)

- improved RAM size (from 256MB to 1GB)

- additional user SSD with 4GB storage space for various logs (e.g. CAN/GNSS data logs)

- high-speed CAN now supplied instead of optional

The development of the software framework follows the idea of a suitable communication stack and API framework to cover the needs brought up by partners. Figure 1 (ETSI reference architecture) shows the fundamental system reference architecture on which the framework is based.

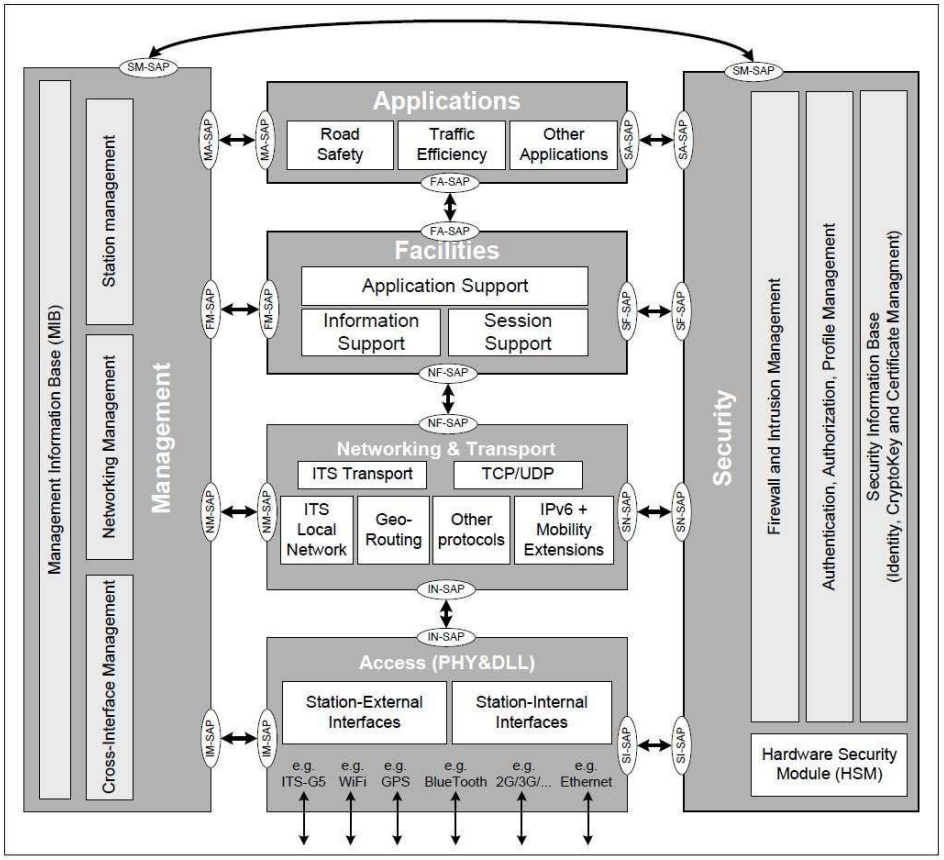


Figure 1. ETSI reference architecture

The ETSI (European Telecommunications Standards Institute) reference architecture aims for a complete system. The software framework developed for this project does not implement the complete ETSI reference architecture due to its tremendous complexity.

However, all necessary layers to provide stable operations able to fulfil the given task within this project have are being implemented.

The layers being developed are as follows:

- Link-/Lower-Layer (access to PHY / DSRC-HW)

- Facility-Layer

- Management-Layer

Although for true ITS stations (doing V2V) a fully compliant network and transport layer (NWTL) would be necessary, due to the complexity of the NWT layer only a minimalistic subset is being developed.

Also, the security layer and the application layer are omitted for this project.

Progress on VANET packet scheduling /routing

This task includes first of all the development of a two-layer network architecture and secondly the modelling of the vehicular network as a Constraint Queuing Network (CQN) enabling the development of packet scheduling/routing policies. A third goal which was pursued in parallel was the design of communication protocols for information dissemination.

The progress towards these goals has occurred through the following steps:

1. Development of clustering method for scalable V2V communication in VANETs that uses a mobility-based metric based on 'virtual forces' applied between nodes according to their current and their future position and their relative mobility. The force applied between vehicles reflects the ratio of divergence or convergence among them.

2. Articles produced:

   Leandros Maglaras and Dimitrios Katsaros, "*Distributed clustering in vehicular networks*", Proceedings of the 2nd IEEE International Workshop on Vehicular Communications and Networking (VECON), In conjunction with the 8th IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), Barcelona, Spain, October 8-10, 2012.

   Dimitrios Papakostas and Dimitrios Katsaros, "*Building integrity in ad hoc networks: Evaluating a randomized MIS-based clustering algorithm*", submitted for journal publication, autumn, 2012.

   Development of a centralized delay-aware and throughput-optimal backpressure controller. Article produced:

   Leandros Maglaras and Dimitrios Katsaros, "*Layered backpressure routing for delay reduction in ad hoc networks*", submitted for journal publication, summer, 2012.

   Development of a distributed air index for smart I2V communication which helps clients locate popular information quickly. The partners implemented a simulation environment to investigate the performance of the proposed scheme and presented detailed experiments that assess the superiority of the method, clearly outperforming the state-of- the-art distributed broadcast index.

Article produced:

Leandros Maglaras and Dimitrios Katsaros, "Distributed skip air index for smart broadcasting in Intelligent Transportation Systems", Proceedings of the IEEE Intelligent Vehicles Symposium (IV), IEEE Intelligent Transportation Systems Society (ITSS), Alcala' de Henares, Madrid, Spain, June 3-7, 2012.

1. Development of a VANET simulator, which is be used for simulation of 'tasks' at the network (e.g., clustering, geo-routing) and application (e.g., data mining) layers.

2. The VANET simulator is used to test the performance of stationary and new dynamic

distributed clustering algorithms for real scenarios on highways. A screenshot of it is provided below:

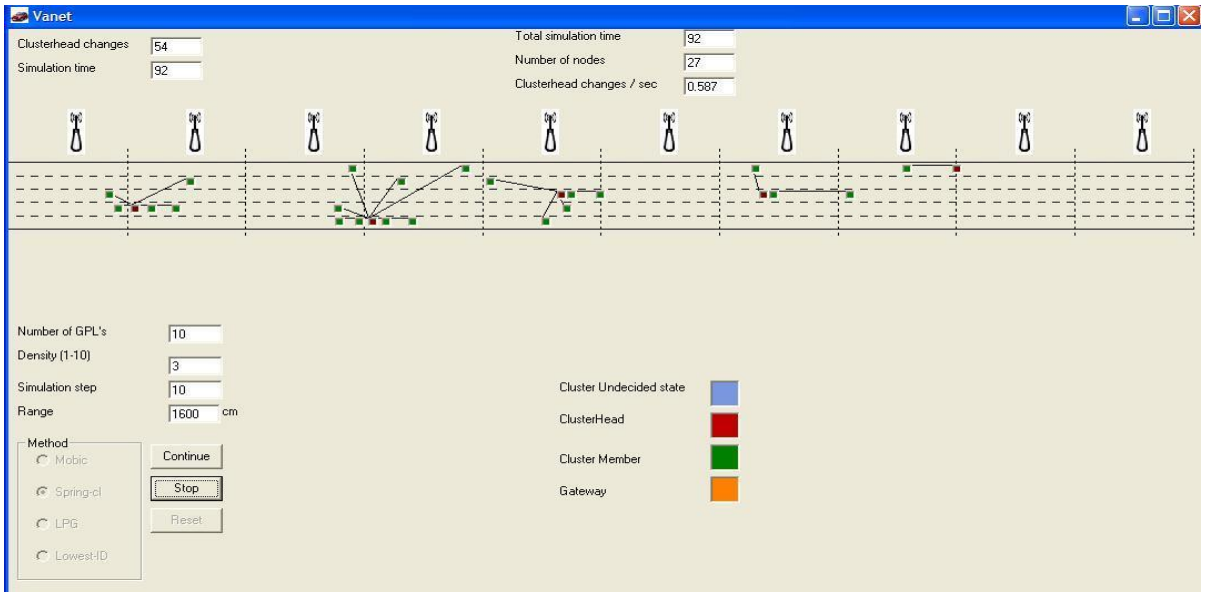


Figure 2. VANET simulator

Significant results

Evaluation of a message-optimal randomized clustering algorithm for mobile ad hoc networks, and development of a new vehicle clustering protocol.

Development of a delay-aware and throughput-optimal backpressure controller for packet scheduling in dynamic ad hoc networks.

Development of an easy-to-use simulator for VANET research, appropriate not only for physical/MAC/network layer simulation, but also for research in the application layer, which is important for the rest of the REDUCTION partners.

The next step following in 2nd year of the project is to tackle issues in taking advantage of using multiple OBC protocol interfaces to exploit V2V and V2I capabilities at the same time, with the objective to increase communications efficiency and handle the interplay between V2I and V2V data transmission and computation distribution.

2.2 WP2 Predictive Analytics Models for Energy-Efficient Driving and Driver-Behaviour Adaptation

Summary of WP 2

The main objective of WP2 is to develop novel algorithms for creating predictive analytics models that will operate in the decentralized environment of REDUCTION. The proposed prediction models will enable the generation of knowledge for supporting driver-behavior adaptation in order to educate drivers about ways of energy-efficient driving. Therefore, this work package has also the objective of developing distributed data mining algorithms that will be designed to run onboard and exchange computation and data with other vehicles and with the centralized infrastructure.

Work package objectives for the current reporting period

In reporting period 1 the first objective to be fulfilled has been the defining of software architecture of the methods to be used in the basic and advanced prediction models. The prediction models developed should later on be used in the field trials to be fulfilled in WP 5. The activities conducted by the partners in WP included a comprehensive comparison and analysis on different models that can estimate instantaneous fuel consumption/GHG emissions by using GPS data and a 3D spatial network. An evaluation framework for the aforementioned models was developed. Initial results from the evaluation framework show that GPS-based driving behaviour indicators (e.g., the instantaneous velocity and acceleration derived from NMEA sentences/GPS data) and instantaneous fuel consumption/GHG emissions are highly related. Some models demonstrate similar behaviour, while other models do not.

Progress towards the objectives and tasks completed

<u>Progress in requirement specification and software architecture</u>

The requirements for a system prototype to be developed in WP 4 collected by the REDUCTION partners include the following:

1. GPS data can be collected and stored in database.

2. GPS data have to be mapped to a digital map.

3. CO2 emission data from CAN-Bus can be collected and stored in database.

4. An off-line advisory feedback is provided to the driver in response to his driving records.

5. An on-line advisory feedback is provided to the driver in response to his driving records, for example a warning message is displayed to the driver in case non Eco-friendly driving pattern was detected.

6. An on-line feedback is given to drivers to prevent events possible in the immediate road neighbourhood in order to achieve safe and time efficient driving, for example a warning message is displayed to the driver in case an event is detected ahead.

7. Personalized Eco-routing is provided to deliver personalized route paths that would be eco-friendly by the driver's personal standards

The software architecture that will be developed in Task2.2 is based on Trinite's system. However, the system architecture can be used by any other system with a distributed middleware. It consists of four components which are explained below.

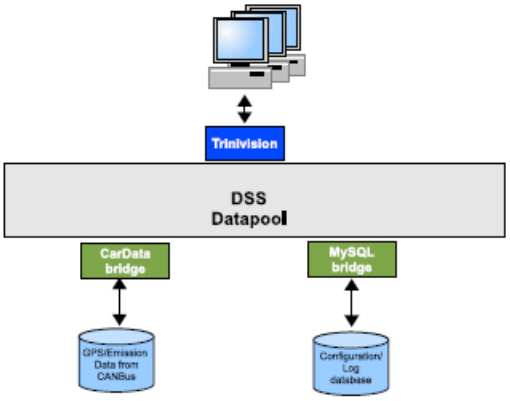


Figure 3. DSS data-pool

DSS data-pool. Dynamic Subscribe System (DSS) data-pool is a real-time public subscribe distributed middleware. It provides a level of abstraction, by hiding the complexity of a variety of platforms (Different servers with different operational systems), networks and low-level process communication. Application developers may concentrate on the current requirements of the software to be developed, and use lower-level services provided by the middleware when necessary.

Trinivision. This is a standard DSS user interface, which is presenting DSS visual objects. It can be used in both personal computers and smart phones via web application.

Database bridge. The interface between the DSS data-pool and database is called a database bridge. DSS uses it to read/write data from/to database. MySql database bridge is used within the

Trinite enviroment.

CarData bridge. This represents the interface between the DSS data-pool and in-car systems. DSS uses it to read all kind of vehicle related data, such as GPS and CO2 emission data.

Progress towards the prediction models and algorithms

To develop novel algorithms for the creation of the prediction models, a broad range of the Intelligent Transportation Systems literature was inspected and the fuel consumption impact of the tasks were analysed.

Three problems were isolated, with the most fuel saving impact: Eco-Driving, Eco-Routing and Distributing Data Mining. The state of art literature Eco-Driving and driving behaviour analysis was reviewed. The problem was re-formalized as a dynamic model that continuously analyses a driver's behaviour data and provides feedback messages back, in order for the driver to adapt their style.

In order to achieve the analysis of driving behaviour data, the partners have converted the feedback computation process into time-series classification. The CAN Bus messages that describe behaviours come in time-series form like acceleration/throttle per time unit. Therefore, the state of art in time-series classification was analysed and a novel algorithm to classify invariant time-series was designed.

A new algorithm was designed which handles the temporal invariance / deformations of a time series by modifying the decision boundary of the maximum margin classifiers like Support Vector Machines. The support vector instances of a training set are transformed using a novel transformation technique, such that the new produced virtual instances incorporate necessary variations of the original instances.

The transformation is data-driven and utilizes the distribution of variations among the instances, by building interpolating warping paths of instances into warping maps. The warping maps are analysed for variations at specific locations of the time series and the average variations are yield into transformation fields. Once the transformation fields are computed, they are applied in the support vector instances using the Moving Least Squares method. The final outcome produces new virtual instances, which are inserted into a larger training set and a maximum margin classifier is retrained.

The new dataset incorporates the necessary time-series variations and decision boundary is redefined, so classification is boosted. The method was implemented in Java. Abundant experiments were run on 35 datasets of the UCR collection and the results demonstrate significant improvements compared to the state of art techniques. A publication presenting the idea was submitted and accepted at the ECML2012 conference.

Literature on routing was also reviewed. A personalized travel time prediction algorithm was developed in order to have a route that predicts the travel time based on the historical data of the driver including his trips and times. An algorithm was designed to compute personalized travel times. A matrix of road segments per vehicle is constructed from history with all cells being the recorded times. A prediction for the non-observed cells is constructed using a derived learning method via matrix factorization. Similarly for efficient prediction of fuel consumption the method is analogous with fuel consumption per segment filled into the matrix. Rarity of time series is an issue faced in real data, therefore the consortium has developed a method to efficiently classify time series using supervised dimensionality reduction learned with stochastic gradient descent, that projects only the observed segments to a lower dimensionality space, and classifies the projected time-series instances.

An implementation was completed, additional baseline methods were implemented and experiments were conducted. The method was published in the AAAI2012 conference. Consultations and feedback was provided to TRI regarding the architectural design involving infrastructure needs of WP2, including storage of GPS, geographic map repository for storing the digital maps to do the position to road conversion and the communication protocols to provide real time feedback to the driver.

The literature of distributed data mining was inspected for works related to VANET applications of transportations. A novel technique was designed for light weight classification in a P2P network in a distributed fashion. Reduced-SVM (RSVM) is implemented with the concept of reduced set of Support Vectors to be communicated with reduced overhead but keeping comparable classification accuracy to

centralized methods. The method was published in GFKL2012.

Finally, the summary of results obtained in WP 2 through the prediction models was published in the deliverable D2.2 “Basic Predictive Analytics Model”.

2.3 WP3 Data Management for Environment Aware Routing and Geo-Locational Analysis Application

Summary of WP 3

The objective of WP3 is to design and develop a software prototype that can convert vehicle-related data, primarily GPS data, to metrics that capture environmental impact. The prototype must handle very large volumes of data from different types of vehicles and must efficiently compute the multi-modal eco-routes in both real-time and offline modes. In addition, the prototype must be able to report on the temporal evolution of eco-routes, e.g., due to a variety of changes in the transportation infrastructure and its use. The work package will

a) define the interfaces for how vehicles communicate with the server side and with each other,

b) invent and prototype techniques for computing eco-routes,

c) invent and prototype techniques for the validation of eco-routes,

d) design and prototype high-performance data structures and algorithms for the handling of very large volumes of streaming data from the vehicles, and

e) invent and prototype efficient, off-line data mining algorithms capable of monitoring and reporting on the temporal evolution of eco-routes.

Work package objectives for the current reporting period

In WP 3 the consortium has set its focus on defining the requirements for eco-routes. An extensive research on literature with the topic of processing and utilizing Geographic Position Data has been conducted in order to define the software architecture needed for eco-routing. A comprehensive comparison and analysis on different models that can compute aggregated fuel consumption / GHG emissions by using GPS data and a 3D spatial network have been conducted.

Progress towards the objectives and tasks completed

<u>Progress towards the specification of requirements for eco-routes</u>

This task has focused on describing the requirements for a software prototype that can convert vehicle-related data to metrics that can capture the environmental impact. The vehicle related data is mostly GNSS data and CAN-Bus data. The partners have used a number of use cases to establish the requirements to the system. A detailed study included in Deliverable 3.1 due in Month 6 lists the requirements to the data foundation, divided into what is needed and what could be useful. A study of related work divided into EU-funded projects and academic papers compares the system designed to what is currently possible. In conclusion, it is found that all requirements are covered by use cases. In

addition, all use cases are used.

In short the consortium has defined the requirements for the system as follows:

“The system efficiently computes and evaluates eco-routes for vehicles. Focus is on the transportation of people (passengers), and all vehicles are assumed to be operated by a dedicated driver such as a taxi or bus driver.

The system stores and processes huge volumes of traffic-related data in a scalable and efficient manner. The data is received from a diverse set of vehicles. In addition, data from various operative systems are used to manage both single vehicles and fleets.

The system outputs evaluations of the environmental impact of a single trip and of a set of trips. This output is used as feedback to the operative systems such that the environmental impact of trips can be used as a new optimization and quality parameter in the scheduling of trips.”

The table below shows the mapping of requirements against the use cases in this task.

Requirement	Use Case
Load/update basic map	Load Basic Map
Load/update specialized map	Load Specialized Map
Load GNSS Measurements in Batch	Load GNSS Data
Load GNSS Measurement in Real-Time	Load GNSS Data
Load CANBus Data in Batch	Load CANBus Data
Load CANBus Data in Real-Time	Load CANBus Data
Load Passenger Requests	Load Passenger Requests
Load Tour Related Data	Load Tours
Convert GNSS Measurements to GHG Emission	Build Eco-Map
Combine GNSS Measurements and CANBus data	Build Eco-Map
Annotate Existing Map Technology with Eco Routes	Build Eco-Map
Estimate GHG Emission for a Single Trip	Evaluate Single Trip
Compare and Contrast GHG Emission for a Single Trip	Evaluate Single Trip
Estimate GHG emission for a set of Trips	Evaluate Fleet Trips
Compare and Contrast GHG Emission for a Set of Trips	Evaluate Fleet Trips

Evolution of of Eco-Routes	Update Basic Map

Figure 4. Mapping of requirements against use cases

Progress in the eco-routing methods

The following objectives have been defined for the development of eco-routing methods:

- Convert the data available into existing metrics for the capture of environmental impact, e.g. greenhouse gas emissions
- Propose basic eco-routing techniques, and ensure that the eco-routing techniques invented are conceptually sound, correct, and offer adequately and predictably accurate environmental impact estimates.
- Evaluate and validate the results provided by the eco-routing techniques proposed. Here the use of fuel consumption and other vehicle data is expected to be used. This evaluation and validation must support the field trials carried out in WP5. Extensive experimental studies are expected where alternative routing and evaluation techniques are assessed and improved.
- Provide output map formats that are easy to integrate with existing mapping solutions so that the eco-routes can be easily included in reports to transport authorities or offered as feedback to the individual drivers.

The GPS data and CANBus data is the data foundation stored and used to compute eco-routes. Considerable effort to implement the data warehouse for both storing low-frequency and high-frequent GPS data has been done. In particular the ETL process has been designed to be very flexible and make it simple to take new GPS data sources into consideration.

Basic techniques developed to serve the task of developing eco-routing methods are as follows:

A 3D spatial network. This refers to a 3D spatial network that provides grade information for all road segments. This network is constructed by using a laser scan point cloud for lifting a 2D spatial network. The use of laser point data yields a model with high accuracy.

Experiments on generating a 3D spatial network for the Aalborg region and North Jutland region were conducted, and initial results on efficiency and effectiveness of the proposed methods are available. A framework that can annotate graph edges with eco-weights using a set of (trip, cost) pairs is being designed. A travel cost (e.g., travel time, fuel consumption, GHG emissions) prediction framework that makes use of both historical and real-time GPS data is being designed.

An investigation of environmental impact models. This includes a number of models that have been proposed with the aim of quantifying the emissions of a vehicle based on GPS data from the vehicle and a 3D model of the spatial network the vehicle travels in.

Techniques for basic eco-routing tasks. The algorithm is developed based on the classical routing

algorithm, i.e., Dijkstra's algorithm.

A graph for modeling spatial network is proposed that records information about road intersections and road segments, and measures the length of each road segment, the travel time required to traverse the road segment, and fuel consumption or GHG emission on the road segment.

The implementation of the graph is based on OpenStreetMap, and thus formats of the proposed network graph and OpenStreetMap can be transformed between each other. Based on the proposed network graph, the classical Dijkstra's algorithm is adapted to develop the eco-routing techniques.

Intensive experiments have been conducted. The classical Dijkstra's algorithm and the eco-routing Dijkstra's algorithm are utilized to compute the shortest routes, the fastest routes and the ecoroutes. Three types or routes are compared with each other.

On the basis of the eco-routing methods above a prototype for basic eco-route prediction has been developed. The output of the prototype is a Shapefile that is mostly suited for IT-person that wants to experiment with travel-time and eco-route. In addition, the prototype has a simple web interface where the public can query a map for the travel-time and eco-route between two addresses.

2.4 WP4 System Design and Integration

Summary of WP 4

The main objective of WP4 is to have a real-time publish-subscribe distributed middleware with a generic functionality. Components may subscribe for information, unsubscribe, publish information, and notify that they are interested in some kind of information. The Event Handler receives all these events through an interface, and can also notify components when the information is of relevance for them. The publish-subscribe communication mechanism will support an asynchronous (non-blocking), many-to-many communication between components in the network.

Work package objectives for the current reporting period

The main objective of WP4 in reporting period 1 is to have a real-time publish-subscribe distributed middleware with generic functionalities. Requirements on software level for the envisaged final software product have been collected and the software architecture is defined. The software architecture is based on the principles of i) publish-subscribe, and ii) distributed middleware. The software development of the case studies in WP5 will use the system design and architecture in this work package as a framework to integrate different functionalities.

Progress towards the objectives and tasks completed

In this reporting period the functionalities from different work packages have been collected and analysed in order to define the software design.

Progress towards requirements specification

Functionalities in WP 1

The functionality tested in WP 1 was wireless communication including V2V, V2I and I2V technologies. Its objective is the development of the onboard technology taking into consideration the requirements for supporting multi-modal fleets.

The communication architecture to be implemented will rely on the European ITS Communications Architecture (ECA) standardised by ETSI, however it will include a light-weight version of this with only the vital functionalities. The V2V and V2I technologies allow the data from a vehicle to be transmitted to vehicle, mobile and central ITS stations via three operations: geoBroadcast/anycast, geoUnicast, topoBroadcast. Unicast routing is a fundamental operation for vehicle to construct a source-todestination routing. GeoBroadcast/anycast is the forwarding mechanism that transports data from a single node to any of the nodes within a geographically area. TopoBroadcast offers re-broadcasting of a data packet from a source to all nodes that can be reached in certain number of hops. I2V technologies refer to the use of Bluetooth broadcasting, which only be used to receive data and use the data to measure the average travel time. BluetoothBridge is also used to send information back to the user within the REDUCTION project. The Bluetooth broadcasting demo program and the Bluetooth broadcasting source code (both in python and C++) are founded in book. Since the broadcasting is a synchronous action, an innovative asynchronous action has to be implemented in order to broadcast information to more users at the same time.

Functionalities in WP 2

For the architectural design of the system involved with WP2 of the Reduction Project and more specifically the Optimizing driving behaviour section. The main objective of WP2 is to develop novel algorithms for creating predictive analytics models that will operate in the decentralized environment of REDUCTION. The proposed prediction models will enable the generation of knowledge for supporting driver-behavior adaptation in order to educate drivers about ways of energy-efficient driving. The following set of functionalities should be implemented:

a) Eco-Driving

In order to improve the driving behavior, with the ultimate goal of reducing fuel consumption, drivers should consider the adaptation of their driving style. UHI will provide on-line and off-line advisory feedback to the driver in response to his driving behaviour records. The feedback will be characterized as follows:

On-line Driver Eco-awareness Feedback: The driving behavior will be described via collected signals and sensory inputs regarding vehicle CAN-Bus messages, such as speed, accelerator, gear changes, brakes and fuel consumption. A prediction model will use the recent messages of a specified time window and build an advisory method which outputs certain feedback warning messages to the driver in case non Eco-friendly driving pattern was detected.

Off-line Driver Behavior Analysis: In addition to the on-line feedback, the data constituting the driving pattern over long-term distances will be collected and analyzed. Such off-line processing aims at detecting and identifying certain driving patterns of a driver in comparison to other drivers' behaviors under similar driving conditions. In the end of the analysis classification and cluster, feedback will be provided to the drivers and the fleet managers.

b) Safe driving

Predicting driving and traffic patterns in a road neighborhood, for applications like safe and time efficient driving, distributed learning algorithms are needed to be designed for large scale ad-hoc networks like VANETS. UHI will provide a distributed data mining model designed to give on-line feedback to drivers that can predict events possible in the immediate road neighborhood.

Cooperative Prediction of Road Neighborhood Dynamics. A local learning algorithm on each vehicle will receive position, velocity, acceleration, heading and yaw rate measurements from all connected vehicles in its immediate road neighbourhood in order to predict future event in this road segment. The local algorithm will use this data to learn a model periodically, and each vehicle will also share its decision/prediction about a certain event.

c) Personalized Eco-Routing

Eco-Routing represents the process of suggesting particular routes in order to reach a destination, which would result in the most eco-friendly usage of fuel. In comparison to existing approaches which suggest the same route to various types of drivers in a table look-up manner, the methods will pay attention to the drivers past routing history, in order to deliver personalized route paths that would be eco-friendly by his personal standards. Predictions will be based on personalized travel time estimation per link for the shortest time route finding, or personalized fuel estimation in case of overall best fuel consumption path optimization.

The functionality of personalized Eco-routing will be merged in WP3 for system integration.

Functionalities in WP 3

For the architectural design of the system involved with WP3 of the Reduction Project and more specifically the Eco-routing section. The objective of WP3 is to design and develop a software prototype that can convert vehicle-related data, primarily GPS data, to metrics that capture environmental impact. The prototype must handle very large volumes of data from different types of vehicles and must efficiently compute the multimodal eco-routes in both real-time and offline modes. In WP 3 the following set of functionalities has been implemented:

a) Eco-routing algorithms

In this section, three types of Eco-routing algorithms are summarized for the different data-source types:

Time-to-Eco.

The idea in the Time-to-Eco algorithm is to use the very large quantities of low-frequent GNSS measurements that are available to the REDUCTION project, see Table 2. This data-source type is well-suited to be used for estimating travel-time as indicated in Table 2 but not as well-suited for estimating eco-routes. However, the large data size makes this data-source type very attractable

to use also eco-routing and therefore this subsection proposes an algorithm for converting travel-time

to an estimation of fuel consumption.

Trajectory-to-Eco.

The basic idea in the Trajectory-to-Eco approach is base on the estimation of eco-routes on the speed and acceleration of a vehicle. The speed of the vehicle is directly available from the data; however the acceleration must be estimated. To do this estimation the GNSS measurements are pair wise compared.

CAN-Bus-to-Eco

The CAN-Bus-to-Eco approach is the simplest approach for enabling a data-source type to be used for eco-route estimation because the actual fuel consumption is directly available in the CAN-Bus data.

b) Fuel consumption models

The CAN-Bus data is needed to apply the Eco-routing algorithms above. However, the CAN-Bus data is not always available. Thus, a method is needed to estimate fuel consumption and GHG emission. The methods for estimating fuel consumption and GHG emission have been developed for several years. In the context of road transportation, Fuel consumption and GHG emission models are classified into macroscopic and microscopic models in.

c) 3D Eco-routing

Eco-routes are highly correlated to the elevation of road networks, thus 3D Eco-routing can provide more optimal routing information, resulting less fuel consumption. A 3D spatial network lifted by a 2D spatial network from Open Street Map (OSM) and a laser scan point cloud in. A laser scan point cloud consisting of (x, y, z) samples of the surface of geographical space are obtained from a low-flying aircraft. Then 3D Eco-routing can be calculated based on the above Eco-routing algorithms.

Progress towards software architecture

Based on the functionalities collected in WP 1,2 and 3 the partners have created the software architecture of the system integration. The system architecture can be used by any other systems with a distributed middleware and it consists of 7 components:

DSS data-pool

Dynamic Subscribe System (DSS) data-pool is a real-time distributed middleware. It provides a level of abstraction, by hiding the complexity of a variety of platforms, networks and low-level process communication. Application developers may concentrate on the current requirements of the software to be developed, and use lower-level services provided by the middleware when necessary.

Trinivision

Trinivision describes a standard DSS user interface presenting DSS visual objects. It can be used in both personal computers and smart phones via a web application.

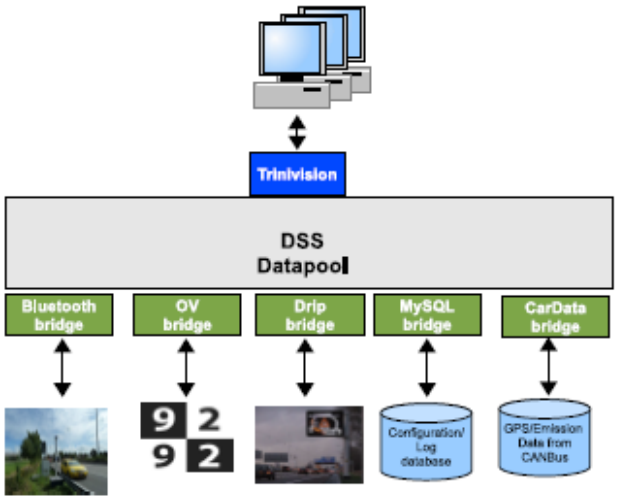


Figure 5. Trinivision

Database bridge

The interface between the DSS data-pool and database. DSS uses it to read/write data from/to database. MySql database bridge is used within the Trinite environment.

CarData bridge

The interface between the DSS data-pool and In-car systems. DSS uses it to read all kind of vehicle (including personal cars, trucks, busses, minibuses and other vehicle types) related data, such as GPS and CO2 emission data.

Drip Bridge

The interface between the DSSdata-pool and VMS devices. OV Bridge The interface between the DSSdata-pool and the public transportation information system, such as 9292ov.nl in the Netherlands.

Bluetooth Bridge

The interface between the DSSdata-pool and Bluetooth detectors. Besides the middleware functionality the DSS data-pool also addresses the business logic. All above objects are implemented in the data-pool. Figure 12 zoomed in into a small part of the DSS data-pool. The balloons represent the objects, the arrows represent the data flows between each object. The objects within the DSS data-pool are explained below.

CarObejctItem

It is responsible for all the communication and providing data of the corresponding CarObject to the Desktop (User interface). CarObject It gets real-time data of vehicle related data through signal updates and stores the data in database. The prediction model in T2.2 will be applied in this object.

Link

It represents a segment of road in one direction without crossings or other choice or merge points except the begin and end point. It gets GPS data and CO2 emission data from CarObject or other sensors.

Route

It consists of a number of links. It manages the set of routes from one origin to one destination. It gets GPS data and CO2 emission data from CarObject or other sensors. It also gets real-time data of links through signal updates. The Eco-routing algorithms in T3.3 will be applied in this object.

OdMgr

It represents the relation between an origin and a destination and comprise one or more routes. It gets real-time data of routes through signal updates. It also gets the schedule of public transportation via OVBridge. It can send information to VMS and Bluetooth bridges.

OdMgrItem

It is responsible for all the communication and providing data of the corresponding OdMgr to the Desktop (User interface).

EcoMap

It consists of all links with CO2 emission data. It is used to send Eco data to smart phones.

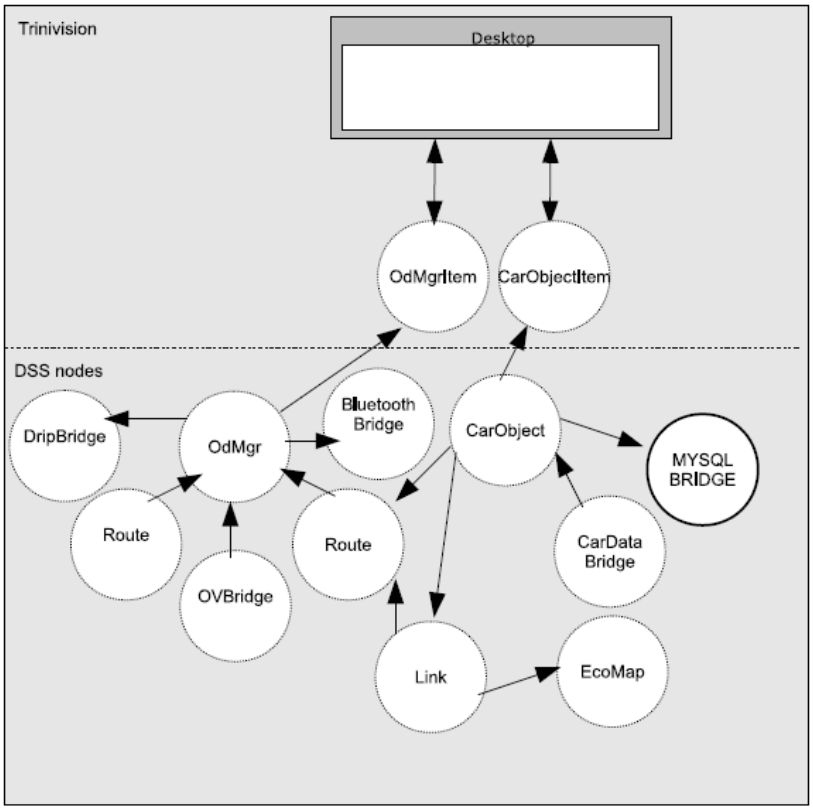


Figure 6. Objects relations in the middelware

2.5 WP5 Case Studies for assessing Energy-Efficiency and CO2 Reduction

Summary of WP 5

The goal of this task is to twofold; firstly, to confirm that the architecture of the REDUCTION system is generic enough to encompass diverse “application” scenarios, and secondly, to provide useful input to the partners for any omissions concerning the operational part of the system, that might have got unnoticed, or to develop more advanced features for the system. Therefore, the existence of several field trials is mandatory, multimodal and traditional as well.

Work package objectives for the current reporting period

The main task in WP 5 for the first year of the project was the collection of initial requirements for the fleet management system. The goal of this task is to confirm that the architecture of the REDUCTION system is generic enough to encompass diverse “application” scenarios, and secondly, to provide useful input to the partners for any omissions concerning the operational part of the system, that might have got unnoticed, or to develop more advanced features for the system. These should be used in the case studies to be done by the partners BEK, TRAINOSE and CTL and each case study comprises two field trials.

Progress towards the objectives and tasks completed

Progress towards initial requirements collection

The requirements and expectances from the cases studies were analysed by the partners. The field trials are carried out in Cyprus, Denmark, and Greece. The goals of the field trials are quite different from site to site therefore each set of field trials has different requirements. In the first field trial the main purpose is to test the functionality of the various parts of the system. The lessons learned in these first field trials are used to alter and extend the system. The updated system is then tested in a second field trial. The outcomes of the last field trials are the practical results of the REDUCTION project.

I. Field trial for BEK

The focus in the first field trial is the basic usage of both travel-time and eco-route estimates. The first field trial may be geographically limited because the distribution of particular CAN-Bus in the region where BeKTra/FlexDanmark schedules transport is currently highly skewed. Performance issues will not be addressed at all in the first field trial. The BeKTra/FlexDanmark case study mostly focuses on using the result from WP3 and studies the usage of travel-time and eco-route in the scheduling of mostly taxis.

The partners AAU and AU collaborated with BeKTra/FlexDanmark for the first first field trial. This included activities such as:

- Discussion with map providers and comparison to open-source alternatives in particular the use of Open-Street Map (OSM).
- Considerable testing if OSM can be used at the digital map foundation in the two BeKTra/FlexDanmark field trials in WP5.
- Evaluation of how existing software stack at BeKTra/FlexDanmark can use the result produced in the Reduction project to get as accurate an estimation of the expected positive impact.
- Providing requirements for the first field trial on eco-routing. This included studies of the general setting of the BEK field trial

II. Field trial for TRAINOSE

The TRAINOSE case study mostly focuses on the implementation and design of multimodal transportation services. These services offered to the public by an on purpose web-site designed and the support for multimodal algorithms. The final goal is to offer low cost and CO2 footprint optimized route.

For the purposes of REDUCTION project implementation and in accordance to action WP5.1 the following goals has been achieved by TRAINOSE S.A., especially the research and development team.

Architectural Design

The architectural design of the basic architectural elements for multimodal passenger travel has been

finished.

The type of web application, the database design has been completed. The functional requirements of the web application have been defined as well.

Web Application for providing multimodal services to its passengers

The Web application is almost finished. Few modifications are necessary to be applied and the current completion level is at 90%.

Shortest Path algorithms for the multimodal application have been developed and intergraded to the web application.

Multimodal Algorithms

Multimodal Algorithms are in a design phase where features like execution speed, memory consumption and complexity are under study Data Base for storing train and bus schedules has been designed and constructed as well according to WP5.1.

Bus schedules have been defined for all Greek territory covering 76 Greek Cities.

Train Schedules have been defined for the three main Intercity rail lines covering the following Greek cities Athens, Thessaloniki, Larisa, Volos, Alexandroupoli, Edessa, Serres, Drama, kalambaka, Veria.

First Field Trial

The first field trial focuses the service offering to Greek passengers. Every Greek passenger who visits the main company page will be asked to use the multimodal trip site in a way that looks like a survey.

Expected results behind this phase is two-folds

1. Users Perceptions of eco-friendly traveling.

2. Debugging and refinement of the application.

Second Field Trial

The second field trial will focus on the improvement over the multimodal algorithms by taking account dynamic factors and time windows. First trial proposes a simple algorithm multimodal trip service while the second trial proposes a much more advance multimodal tip service where the time start time of the trip plays a crucial role to the transportation means combination. If a customer asks for a journey that starts at 06:00 gets a different combination of transportation, than if the trip starts at 18:00. The final refinement is to offer an almost door-to-door service and integrate this with communication devices.

III. Field trial for CTL

The partners in this field trial are:

· CTL Cyprus Transport Logistics Ltd (CTL)

· Ministry of Communication and Works Public Works Department (MCW-PWD) (Nicosia, Cyprus)

Phase 1: Field trial for CTL (UTh, CTL) - The first field trial for CTL will involve the following tasks: 1) Identifying the area that will be used to implement the REDUCTION vehicle routing algorithms, 2) Conduct travel time and traffic count studies on a selected set of routes for model calibration,

3) Design the field test of REDUCTION.

4) Request and secure the participation of the Cyprus Public Works Department in data gathering such as GIS, historical traffic counts, historical travel times, bus routes and schedules, historical bus occupancy and fares,

5) Request and secure the participation of at least one delivery company in the field trial,

6) Request and secure the participation of one or more bus fleet operators of Nicosia and the greater Nicosia region,

7) Assist in the development of a green route points system for the participants.

Phase 2: Field trial for CTL (UTh, CTL) - The goal of the second phase is to implement the Nicosia

Cyprus field trial. CTL will undertake the field trial of REDUCTION with the aid of the REDUCTION

partners. CTL will assist in:

1) The data gathering of all pertinent transport network data available from the Cyprus Public Works Department for the field trial,

2) The deployment of the REDUCTION devices in private autos, delivery vehicles and buses,

3) Recruitment of volunteer travellers who will be recruited to participate, and a set of drivers and/or passengers who will be recruited for controlled experiments on designated corridors,

4) Conducting a travel time study at selected corridors of the City to calibrate the REDUCTION routing models,

5) Conducting the actual REDUCTION field trial for Nicosia,

6) Summarize the study and its findings in a report.

After several consultations with the consortium and the local agencies in Cyprus it was decided to conduct the Nicosia field trial to achieve the REDUCTION goals in two parts:

1) Utilize the REDUCTION technologies (hardware and software) to analyze the driving behavior of bus drivers;

2) Utilize a Dynamic Traffic Assignment (DTA) model to analyze the impact of eco-routing on traffic flow conditions, fuel consumption and air quality. This section presents the Nicosia bus driver

behavior filed trial.

The REDUCTION consortium has reached a preliminary agreement with OSEL to participate in the

REDUCTION process. Upon the recommendation of DDE it was agreed that the best option was to use OSEL that has a uniform type of buses reducing the need to utilize a fleet that has various types of vehicle types. This decision is based on the following main factors:

1) Vehicle manufacturers are reluctant to provide the necessary coding for outsiders to read the vehicle CAN-Bus data,

2) DDE would require less effort in programming vehicles of the same type and connecting their devices to the CAN-Bus to extract the necessary data to analyze the driving behavior of the drivers in terms of fuel consumption and air quality.

2.6 WP6 Dissemination, Exploitation, Standards

Summary of WP 6

The results of REDUCTION are made publicly available through peer-reviewed publications, conference presentations, press releases, web pages and brochures. Generated intellectual property is carefully protected, e.g., patent filling. An exploitation and dissemination plan is specified to maximize the outcome and benefit of the project for individual partners. Partners will search for and use existing fleet-management standards used in the EU. Important contributions to these standards are made where applicable.

Work package objectives for the current reporting period

The results of REDUCTION are made publicly available through peer-reviewed publications, conference presentations, press releases, web pages and brochures. Generated intellectual property is carefully protected, e.g., patent filling. An exploitation and dissemination plan is specified to maximize the outcome and benefit of the project for individual partners. Partners will search for and use existing fleet-management standards used in the EU. Important contributions to these standards are made where applicable.

Progress towards the objectives and tasks completed

The task involves dissemination activities of all partners about promoting their findings and results of ongoing research and development in the project. This document reports on events and publications where it is possible to make the results of the project available to a public audience.

In particular, the dissemination includes the following means and activities:

Logo, website and poster of Reduction project.

Events that will be attended by Reduction partners, where the partners will disseminate information of Reduction project and will also discuss results of REDUCTION project.

Publications by produced by Reduction partners that report available results to conferences, workshops, journals, newspapers, etc.

Formal presentations performed by Reduction partners that present available results to international conferences and workshops.

Participation of external bodies in Reduction project that help to raise the public awareness of Reduction project.

Project website

The project website was developed before the kick-off meeting, and is updated timely since its launch. The website address is http://www.reduction-project.eu/. The website was developed in English. Figure 2 presents the home page of the website. In particular, the website contains the following features:

The "Home" page states the title, duration, objectives and expected results of Reduction project.

The "project info" page lists the coordinator and each individual partner of the project. It also presents approach that will be used in the project.

The "Partners" page displays partners involved in the project.

The "Downloads" page allows publications of the project to be downloaded.

The "Contact us" page is designed for people who are interested in the project to get contact with project members.

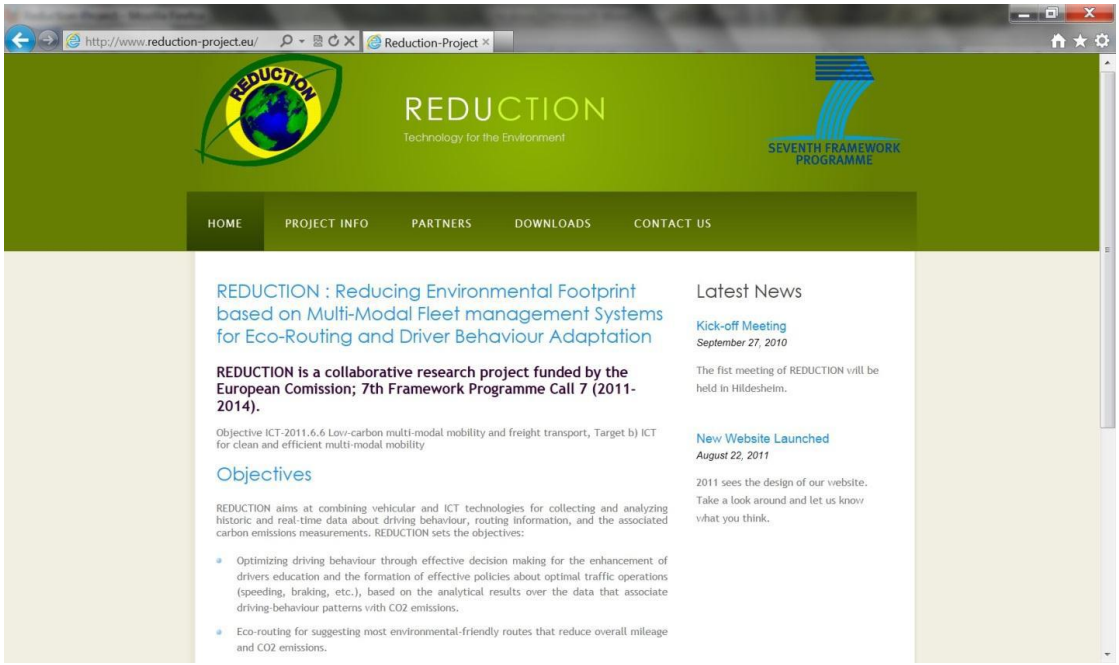


Figure 6. REDUCTION website

The project also has a private online shared workspace. This area allows partners to access to, upload and download documents that are related to the project. This folder includes all documents related to the physical meetings held regularly, all minutes from the physical meetings and telephone meetings, deliverables that have been submitted to the commission, and internal documents that have been circulated among the partners. Login user name and password are provided to each partner.

Project poster

A project poster has been designed, in order to support the promotion of the project at public events and workshops.

The poster provides a brief glance of the project, but concisely presents the key information of the project. In particular, the poster includes the project name and acronym, project type, program, the project coordinator, the project partners, objectives, approach, description of work and expected results.

The poster is available under the link:

http://147.172.223.251/reduction/documents/REDUCTION_Project_Factsheet.pdf.

A detailed list of dissemination activities and publications for REDUCTION can be found under the section "Dissemination activities in Reporting Period 1" below.

Dissemination Activities in Reporting Period 1

Dissemination Activities completed in reporting period			
Nature of activity	**Person responsible**	**Partner**	**Details**
Press Release	Umer Khan, Alexandros Nanopoulos	Partner 1 UHI	Article on the start of Reduction Project, on German newspaper "Hildesheimer Allgemeine Zeitung"
Publication	Josif Grabocka, Alexandros Nanopoulos and Lars Schmidt-Thieme	Partner 1 UHI	"Classification of Sparse Time Series using Supervised Matrix Factorization", which was accepted for poster presentation and appears in the proceedings of the Twenty-Sixth Conference on Artificial Intelligence AAAI 2012
Publication	Josif Grabocka, Alexandros Nanopoulos and Lars Schmidt-Thieme	Partner 1 UHI	"Invariant Time-Series Classification", which was accepted for presentation, poster, and proceedings of the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases ECML-PKDD 2012.

Publication	Umer Khan, Alexandros Nanopoulos and Lars Schmidt-Thieme	Partner 1 UHI	"Experimental Evaluation of Communication Efficient Distributed Classification in Peer-to-Peer Networks", which was accepted for presentation and proceedings of the 36th Annual Conference of the German Classification Society, GFKL 2012.
Publication	Josif Grabocka, Erind Bedalli and Lars Schmidt-Thieme	Partner 1 UHI	"Efficient Classification of Long Time Series", which was accepted for presentation and proceedings of the Fourth ICT Innovations 2012 conference "Secure and Intelligent Systems", ICT-ACT 2012.
Press Release	Josif Grabocka, Lars Schmidt-Thieme	Partner 1 UHI	Newspaper article titled "... diskutieren Forscher, wie Maschinen Lernen", published in the local German daily newspaper TAZ 01/08/2012
Press Release	Josif Grabocka, Lars Schmidt-Thieme	Partner 1 UHI	Newspaper article DPA German Press Agency including a description on the Reduction project. The article is distributed by DPA to multiple media as the newspaper: TIME, Süddeutsche, WORLD, N-TV, Stern, Focus, New Press, Berliner Morgenpost, Bavarian Courier, Suddetsche, Taz, 3/08/2012.
Conference Paper	Dimitrios Katsaros	Partner 2 UTH	Presentation of an article on smart broadcasting (I2V type of communication). See IEEE IV'12 paper in the "PEER-REVIEWED PUBLICATIONS" table. The article ACKs the REDUCTION project.
Conference Demonstration & Short Paper	Leandros Tassiulas & Donatos Stavropoulos	Partner 2 UTH	Demonstration of a real V2I communication. See TRIDENTCOM'12 paper in the "PEER-REVIEWED PUBLICATIONS" table. The article ACKs the REDUCTION project.The demo is also available in YouTube (http://www.youtube.com/watch?v=I3ZuiV6kd58)
Press release	Dimitrios Katsaros	Partner 2 UTH	Publication of an article in the local (greek) newspaper "ΤΑΧΥΔΡΟΜΟΣ" with a description of the REDUCTION project and its first outcomes. Since the online version of the newspaper is only available to subscribers, DKatsaros has put this article in his Webpage (http://inf-server.inf.uth.gr/~dkatsar/papers/REDUCTION_in_Volos_local_press.pdf), apart from the publication of the article in the project's Web site.
Presentation	Kristian Torp	Partner 3 AAU	GN3 Innovation Workshop
Presentation	Ove Andersen	Partner 3 AAU	Meeting about EU Project MOBiNET for smart cities in Europe.

Data release	Kristian Torp	Partner 3 AAU	Creative Commons access to speed map of Denmark using open-street map (OSM) map foundation and GPS data from REDUCTION partner.
Press release	Kristian TorpNiels T. Larsen	Partner 3 AAU	Press release about the general availability of speed map.
Meeting	Ove Andersen Benjamin Krogh	Partner 3 AAU	Meeting with EuroFOT FP7 project partner about possible usage of data from EuroFOT in the REDUCTION project.
Meeting	Kristian Torp	Partner 3 AAU	Two meetings with major truck hauler company about use of GPS data from trailers in the REDUCTION project.
Meeting	Benjamin Krogh	Partner 3 AAU	Several meeting with truck company about usage of their GPS data in the REDUCTION project.
Meeting	Kristian Torp	Partner 3 AAU	Commercial provider of vehicle tracking software for possible collaboration in the REDUCTION project.
Conference Paper	Ove Andersen Benjamin Krogh Krsitian Torp	Partner 3 AAU	Using Low-Frequency GPS data for building a complete Speed-Map of Denmark (In Danish, TrafikDage 2012, Aalborg, ISSN 1903-1092. (Accepted for publication)
Presentation	Ove Andersen	Partner 3 AAU	Using Low-Frequency GPS data for building a complete Speed-Map of Denmark
Conference Paper	Ove Andersen Benjamin Krogh Krsitian Torp	Partner 3 AAU	GPS Data for determining congestion, Vejforum 2012, Denmark, in Danish, (Accepted)
Technical Report	Ove Andersen Kristian Torp	Partner 3 AAU	AN Open-Source ITS Platform (80 pages)
Presentation	C. S. Jensen	Partner 4 AU	Covered Reduction and eco-routing and eco-driving during a keynote at the VLDB 2012 conference.
Conference paper	Yubin Wang	Partner 6 TRI	Paper "On-line Distributed Prediction of Traffic Flow in a Large-Scale Traffic Network", 22-26 Oct 2012, 19th ITS world congress Vienna, Austria
Design Report	Yubin Wang	Partner 6 TRI	Design report "SARAD REDUCTION", 14 June 2012, Uithoorn, The Netherlands
Press Release	Mr. Katsaros/ Mrs. Kaiti Vitou	Partner 8 TRAINOSE	Press release was released on participation of TRAINOSE S.A. to REDUCTION project.

Press Release	Dr. Athanasopoulos Nikolaos, Trainose S.A. Vice President, Mrs. Kaiti Vitou, International Affairs and Public Relations Director	Partner 8 TRAINOSE	Pilot application of TRAIN – TAXI single ticket service in Thessaloniki city metropolitan area and integration with TRAINOSE S.A. ticketing system.
Press Interview	Dr. Athanasopoulos Nikolaos, Trainose S.A. Vice President,	Partner 8 TRAINOSE	Pilot application of TRAIN – TAXI single ticket service in Thessaloniki city metropolitan area and integration with TRAINOSE S.A. ticketing system.
TV and Radio Interviews	Dr. Athanasopoulos Nikolaos, Trainose S.A. Vice President, Director of Strategic Planning	Partner 8 TRAINOSE	Pilot application of TRAIN – TAXI single ticket service in Thessaloniki city metropolitan area and integration with TRAINOSE S.A. ticketing system.
Networking	Mouskos, K and S. Mouskos	Partner 9 CTL	Informing the Cyprus Public Works Department on the start of the REDUCTION project, goals and objectives, September, 2011, Subsequent meetings in December 2011, April, 2012 and August 2012. Informing the OSEL – Nicosia Organization of Nicosia District on REDUCTION and their participation on September 2011. Subsequent meetings on December 2011, April 2012, August 2012

Dissemination activities planned for Reporting Period 2

Dissemination Activities planned for next reporting period			
Nature of activity	**Person responsible**	**Partner**	**Details**
Publication	Josif Grabocka	Partner 1 UHI	Personalized Travel Time Prediction using Collaborative Factorization
Publication	Josif Grabocka	Partner 1 UHI	Supervised Maximum Margin Dimensionality Reduction
Conference Paper	Leandros Maglaras	Partner 2 UTH	Presentation of an article on VANET clustering (V2V type of communication. See IEEE VECON'12 paper in the "PEER-REVIEWED PUBLICATIONS" table. The article ACKs the REDUCTION project.
Conference Paper	Benjamin Krogh	Partner 3 AAU	Trajectories for Novel and Detailed Traffic Information (submitted for publication)
Conference paper	Manohar Kaul	Partner 4 AU	Lifting a Spatial Network Using Laser Scan Data, awaiting for publication.

Journal paper	Bin Yang	Partner 4 AU	Using Incomplete Information for Complete Weight Annotation of Road Networks, awaiting for publication.
Congress	Yubin Wang	Partner 6 TRI	Present paper in 19th ITS world congress Vienna, Austria

Peer-Reviewed Publications in Reporting Period 1

Title	Authors	Journal/Series	Publisher	Place of Publication	Year	Relevant pages	Permanent Identifier	Open Access Y/N	If yes, as of when?	If no, please provide explanation
Classification of Sparse Time Series using Matrix Factorization	Josif Grabocka, Alexandros Nanopoulos and Lars Schmidt-Thieme (Partner 1 UHI)	Proceedings of the Twenty-Sixth AAAI Conference on Artificial Intelligence, AAAI 2012	AAAI Press	Canada	2012	928-934	ISBN 978-1-57735-568-7	Y (Online)		
Invariant Time-Series Classification	Josif Grabocka Alexandros, Nanopoulos and Lars Schmidt-Thieme (Partner 1 UHI)	Proceedings of European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases	Springer	UK	2012	725-740		Y (Online)		
Experimental Evaluation of Communication Efficient	Umer Khan, Alexandros Nanopoulos and Lars	Proceedings of the 36th Annual Conference of the German	Springer	Germany	2012					

Distributed Classification in Peer-to-Peer Networks	Schmidt-Thieme (Partner 1 UHI)	Classification Society, GFKL 2012								
Efficient Classification of Long Time Series	Josif Grabocka, Erind Bedalli and Lars Schmidt-Thieme (Partner 1 UHI)	Proceedings of the Fourth ICT Innovations 2012 conference "Secure and Intelligent Systems", ICT-ACT 2012	Springer		2012					
Distributed Skip Air Index for Smart Broadcasting in Intelligent Transportation Systems	Leandros Maglaras, Dimitrios Katsaros (Partner 2 UTH)	Proceedings of the IEEE Intelligent Vehicles Symposium (IV), IEEE Intelligent Transportation Systems Society (ITSS)	IEEE	Alcala de Henares, Madrid, Spain, June 3-7, 2012	2012	All	http://dx.doi.org/10.1109/IVS.2012.6232223	N	N/A	Also, self-archived by the authors in their Web page
Demonstration of a Vehicle-to-Infrastructure (V2I) Communication Network featuring Heterogeneous Sensors and Delay Tolerant	Donatos Stavropoulos, Giannis Kazdaridis, Thanasis Korakis, Dimitrios Katsaros, Leandros Tassiulas	Proceedings of the 8th ICST International Conference on Testbeds and Research Infrastructures for the Development of Networks and	ICST-Springer	Thessaloniki, Greece, June 11-13, 2012	2012	All	Not yet available, but when it will be published in SpringerLink	N	N/A	Also, self-archived by the authors in their Web page

Network Capabilities	(Partner 2 UTH)	Communities (TRIDENTCOM)								
Distributed Clustering in Vehicular Networks	Leandros Maglaras, Dimitrios Katsaros (Partner 2 UTH)	Proceedings of the 2nd International Workshop on Vehicular Communications and Networking (VECON)	IEEE	Barcelona, Spain,October 08-10, 2012	2012	All	Not yet available, but when it will be published in IEEEXplore	N	N/A	Also, self-archived by the authors in their Web page
Estimation of Fuel Consumption based on GPS Data (in Danish)	Ove Andersen Harry Lahrmann Kristian Torp (Partner 3 AAU)	Trafikdage	Aalborg University	Aalborg	2011	17	ISSN 1903-1092	Y	2012.02.01	
EcoMark: Evaluating Models of Vehicular Environmental Impact	C. Guo, Y. Ma, B. Yang, C.S. Jensen, M, Kaul (Partner 4 AU)	Proceedings of the 20th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL GIS),	ACM	Redondo Beach, California, United States	2012	10 pages		N		Accepted, not yet published.

2.7 WP 7 Project management

Summary of WP 7

This WP will ensure the effectual and timely achievement of goals within the project in the most cost-effective manner. The central objectives are:

- To ensure the effective planning and coordination of work, tasks and outcomes of the individual work packages, including the timely submission of deliverables
- To provide the necessary structures and support to facilitate project management, decision-making, quality management and accountability
- The administration and financial management of the project, including the periodic and final reports to the EU Commission
- To guarantee a continuous flow of information and efficient decisions-making processes within the consortium
- Communications management with external groups and with the EU Commission

WP Leaders also play an important role in technical management preparing the periodic activity reports and finalizing deliverables, but the person month allocation for this work is allowed for in the respective work packages.

Work package objectives for the current reporting period

Work package 7 focuses on the coordination and effective planning of tasks and outcomes in the individual work packages. A major goal of the activities undertaken in this work package is the timely submission of deliverables and milestones and the efficient communication within the consortium and with the European Commission. The objectives of work package 7 for the first reporting period included the establishment of communication structures within the consortium through the creation of the password-protected groupware platform, the REDUCTION website and the establishment of quarterly General Assembly meetings in order to facilitate information flow for project tasks among partners. Internal reporting structures on a quarterly basis as well as the timely submission of deliverables/ milestones have been accomplished.

Project management activities during the current reporting period

- Establish and implement management structures to facilitate planning and coordination of project activities and quality management
- Monitor all contractual, financial and administrative issues
- Ensure effective communication within the consortium and with the Commission and other external stakeholders

Consortium tasks and achievements

The project's Kick-Off meeting was held on the 26th September in Hildesheim, Germany at which the project governance structures (Steering Committee, External Advisory Board) were inaugurated. It has also been decided by the partners that General Assembly meetings accompanied by Steering Committee meetings should take place on a quarterly basis.

The project coordination office established effective internal reporting structures to facilitate project controlling by eliciting quarterly reports on activities from all partners and communication infrastructure to support regular exchange between partners and work packages.

Communication among partners has been facilitated through the creation of a project groupware platform offering the possibility to exchange project documentation and to follow the progress within the project.

A quality management handbook including project governance structures and agreements among partners was created and made available to all partners.

The pre-financing was distributed among all partners by the coordinator directly upon receipt in Month 2 of the project and support has been continuously provided for project partners throughout the reporting period in all project-related financial and administrative matters, including the preparation of the current periodic report.

The project coordinator has also maintained regular contact with the External Advisory Board to update them regarding project events and progress.

A particular highlight in the first half of this reporting period was the participation of Ms. Aria Etemad as representative of the euro-FOT project (http://www.eurofot-ip.eu/) in the REDUCTION meeting in Frankfurt on the 13- 14th of December 2011 to exchange experience in crucial aspects of intelligent vehicle systems.

Deliverables due in Reporting Period 1

D 7.1 Project website and fact-sheet (Month 1). Status: delivered

D 7.2 First periodic report (Month 12 + 60 days). Status: delivered

Problems which have occurred and how they were solved or envisaged solutions

Not applicable.

Changes in the consortium

There were no major changes to the consortium in the current reporting period.

One minor change concerning personnel occurred within the coordinating team at UHI as Prof. Alexandros Nanopoulus is no longer working in the REDUCTION project starting with June 2012.

The tasks of Mr. Nanopoulus have been taken up by other team members at UHI.

List of project meetings, dates and venues

The below table gives an overview of the major project meetings held in Reporting Period 1. Agendas, meeting minutes, participant lists and presentations can be found in the password-protected groupware platform under http://147.172.223.242/bscw/.

Overview of Project Coordination Meetings RP1	
REDUCTION Kick-Off Meeting, Hildesheim, Germany	26th September 2011
General Assembly + Steering Committee Meeting, Rüsselsheim, Germany	13th – 14th December 2011
General Assembly + Steering Committee Meeting, Athens, Greece	13th – 14th March 2012
General Assembly + Steering Committee Meeting, Aalborg, Denmark	19th – 20th June 2012

Reports on meetings

I. REDUCTION Kickoff meeting / Steering Committee/ 26 September 2011, 14:00-15.30, Hildesheim, Germany

Topic 1: Current status of Grant Agreement and pre-financing

1. One signed A form (CTL) send, but not yet received by the coordinator. Once A forms are complete, they will be signed by the coordinator and forwarded to the PO.
Targeted for end of week 39. PO is informed and sees no problem.
2. Missing info about bank details: remaining partners (TrainOSE, BEK) will send the required info to EU Liaison Office, UHA by September 30, 2011.
3. DDE requests to hold back the payment of their pre-financing for 2 months due to internal accounting procedures. Coordinator/EU Liaison Office, UHA will ask PO about this.

Topic 2: Reporting and Reviews

1. Internal project reports are decided to be on a quarterly basis (every 3 months).
2. EU Liaison Office, UHI will send details regarding spending 1 month before.
3. Partners should timely inform the coordinator about over/under-spending.
4. A project meeting will be scheduled jointly with each yearly review.

Topic 3: Policies for Deliverables

1. UHI, TRI and UTH (also BEK, TrainOSE, CTL) agree to send a draft of deliverables of D2.1, D4.1 and D5.1 on Month 6 so we can develop requirements of all work packages in parallel.
2. Every deliverable should be reviewed by at least two persons within the consortium (one from the WP, one outside).
3. The pre-final version of each deliverable should be sent for review 3 weeks before the deadline. Reviewers should provide feedback within 1 week.
4. At every project meeting all partners should present the structure of their forthcoming deliverables.
5. Coordinator will provide LaTeX and Word templates for the deliverables. Each WP has to decide about which format to use.
6. The length of deliverables should reflect the effort that is documented by the deliverable (i.e., the number of person months).
7. Coordinator will provide by end of October 2011 latest a collaboration platform (file sharing etc.)
8. Reviewers for deliverables due month 6:
a. D1.1: L. Gosh (WP internal), L. Schmidt-Thieme (WP external)
b. D3.1: C. Jensen (WP internal), J. Grabocka (WP external)

Topic 4: Financial issues
(no further questions/discussion)

Topic 5: Announcements and Meetings
1. Coordinator will resent the email about the emailing lists and all partners should respond by beginning of October 2011.
2. Project meetings in the first year will be scheduled on quarterly basis (roughly every 3 months).
3. Scheduling of meetings until September 2012: Tentative dates are:
a. December 13-14, 2011: organized by DDE in Frankfurt, Germany
b. March 13-14, 2012: organized by UTH in Volos, Greece
c. June 19-20, 2012: organized by AAU in Aalborg, Denmark
d. September 2012, collocated with the 1st review meeting. Coordinator will ask PO about possible dates. (The tentative dates for meetings in March and June will be finalized in the next 2 weeks)

Topic 6: Misc
1. Invitation of representative from other related projects in next project meeting (December 2011): DDE will invite coordinator (Ford) of project euroFOT.
2. Formation of Advisory Board:
a. Coordinator contacts TomTom (Mr. T'Siobbel)
b. L. Tassiulas (UTH) contacts Prof. Pravin Varaiya (Sensys Networks)
c. L. Gosh (DDE) contacts automobile industries (Daimler, VW) and is granted permission to send the DoW of the proposal.
3. Press releases: all partners will soon proceed to make press releases using material from the factsheet of the project (D7.1).
4. Steering committee meetings are scheduled on a regular basis during the project meetings.

Additional meetings can take place on demand through teleconferences.

II. General Assembly + Steering Committee Meeting, Rüsselsheim, Germany / 13th – 14th December 2011

In the meeting in Frankfurt the scientific progress in each WP has been presented by the WP leader.

The general problem is the unavailability of CANBus data which is slowing work down for the partners.

Topics of the Steering Committee meeting

Topic 1: Reporting and Reviews

1. Problems with the first Internal Quarterly Management Reports (QMR)

   There are frequent delays from some partner with the quarterly management reports. The coordinator asks all partners to allow a timely submission of the management reports containing scientific progress.

2. Decide on the frequency Internal Management Reports

   Internal management reports will continue to be delivered on a quarterly basis.

Topic 2: Policies for Deliverables

1. BSCW (short Demo)

   UHI has created a BSCW platform to upload all REDUCTION documentation and to serve as exchange platform in the preparation phase of deliverables.

2. Assignment of reviewing tasks for upcoming deliverables (including drafts of M12 deliverables)

   A list of deliverables with its reviewers has been put in place to ensure good quality and timely submission of deliverables.

Topic 4: Announcements and Meetings

1. Need for press releases about REDUCTION

   UHI points out that the partners should also focus on writing press releases about REDUCTION.

2. Confirming scheduled upcoming meetings

   Two further meetings have been planned for this first year of the project in Athens in March and in June in Aalborg. The 1st review meeting will take place in fall 2013.

3. Uploading material of meetings (slides, etc.) in BSCW

   The BSCW platform should be used by all partners to upload presentations from meetings as well as agendas and minutes of meetings.

Topic 5: External Advisory Board

1. Finalize participants of EAB

The partners decided to contact the following persons as members of the External Advisory Board:
Mrs. Agnes Voisard - Database and Information Systems Group, Freie Universität Berlin, Institut für Informatik, Germany

Mrs. Svend Tofting – Project Director, Danish platform for the development of intelligent traffic ITS, North Denmark Region

Mrs. Andrea Tomatis – Hitachi

III. General Assembly + Steering Committee Meeting, Athens, Greece / 13th – 14th March 2012

Topic 1: Reporting and Reviews

An explanation has been provided about the obligatory nature of completing the Quarterly Management Reports (QMR) and also about the fact that only approximate MMs are reported without any other financial information.

Topic 2: Policies for Deliverables

1. The status of submitted deliverables of M6 (D1.1, D3.1) is "under review" from EC.

2. The consortium agreed that drafts of the following M12 deliverables: D1.2 (DEL), D4.1(TRI), D5.1(AAU) will be submitted possibly within the upcoming 3 months, for internal review.

3. Agreement on assignment of reviewing tasks for upcoming deliverables in the following table. The involved partners will provide in the next 2 weeks names of persons that will perform the review.

Deliverable Nr.	Deliverable Title	Lead beneficiary	1st Reviewer	2nd Reviewer
D 1.2	Report on advances in the development of onboard technology	DEL	UTH	CTL

D 1.3	Report on Packet Scheduling / Routing algorithms	UTH	TRI	TRAINOSE
D 2.1	Report with data flow analysis and system architecture	TRI	UHI	AAU
D 2.2	Report on basic predictive analytics models	UHI	UTH	AU
D 3.2	Report on eco-routing computation techniques	AU	AAU	UTH
D 3.3	Prototype basic eco-route prediction	AAU	AU	CTL
D 4.1	Report on initial requirements specification and conceptual framework	TRI	UHI	UTH
D 5.1	Report on collecting requirements and specification	AAU	CTL, TRAINOSE, BEKTRA	
D 6.1.1	First Report on Dissemination	AU	UHI	
D 6.2.1	First report on exploitation	TRI	UHI	
D 6.3.1	First report on contributions to standards	DEL	UHI	

D 7.2	First periodic Report	UHI + LUH	ALL Partners

Topic 3: Announcements and Meetings

1. The consortium has agreed to finalize press releases about REDUCTION.

2. The next meeting is scheduled in Denmark on the 19th and 20th of June 2012. The specification of the location will be provided by Prof. Torp.

3. The consortium has been informed about the need to use versioning in BSCW.

Topic 4: External Advisory Board

UTH and DEL will finalize proposals for EAB members in the following 2 weeks.

IV. General Assembly + Steering Committee Meeting, Aalborg, Denmark 19th – 20th June 2012

Agenda Topics:

Topic 1: Forthcoming deliverables (Month 12), Table in Apendix A

Topic 2: Preparation for Next Yearly Report

Topic 3: CANBus Data Legal Request

Topic 4: External Advisory Board

Topic 5: Cooperation with Relevant Projects

Topic 6: Short report about dissemination, exploitation,standards activities

Topic 7: Scheduling the next meetings

Topic 8: Misc

Minutes:

Agenda Topic 1: Forthcoming deliverables (Month 12)

Trinite volunteers to be the second reviewer of Deliverable D.6.3.1, Report on Dissemination

CTL volunteers to be the second reviewer of D.6.1.1, Report on Dissemination

Preliminary sketch of the deliverables for M12 to be by prepared 15 July 2012

Agenda Topic 3: CANBus Data Legal Request

Use-case Partners conducting field trials, CTL, Trainose, Bektra, should ask and submit to UHI the list of vehicles planned to participate, including the model and specifications

Agenda Topic 4: External Advisory Board

- External Advisory Board to be defined
- One industry partner and one academia preferred
- Relevant personalities to be proposed by partners
- Christian Jensen and Kristian Torp will contact Sven Tufting of ITS Denmark and ITS Europe

Agenda Topic 5: Cooperation with Relevant Projects

Proposals will be provided by Lars Schmidt-Thieme to the partners regarding the cooperation with relevant projects. To be discussed during one of the next telcos.

Agenda Topic 6: Short report about dissemination, exploitation, standards activities

Regarding the short report on Dissemination, Exploitation and Standards, AU requires input by partners. AU will send structured request.

Trinite will cooperate with industrial partners in preparing the report on dissemination.

Agenda Topic 7: Scheduling the next meetings

Scheduling of forthcoming meetings:

- Review Meeting Tentative: Brussels, 30 October 2012 and any available day that week
- 5th Reduction Consortium Meeting and Advisory Board Meeting: Frankfurt, 1-2 October 2012
- 6th Reduction Consortium Meeting: Nicosia, 15-16 January 2013
- 7th Reduction Consortium Meeting: Amsterdam, 16-17 April 2013
- 8th Reduction Consortium Meeting: Volos, 9-10 July 2013

Biweekly Teleconference calls will be arranged every second Wednesday at 14:00

Agenda Topic 8: Misc

UHI to provide Reduction presentation template.

In addition, several informal work package meetings and teleconferences have been held to

facilitate the communication concerning tasks / deliverables /milestones.

Impact of possible deviations from the planned milestones and deliverables, if any

None

Any changes to the legal status of any of the beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs;

There were no changes in the legal status of any beneficiaries in the current reporting period.

Development of the Project website, if applicable

The project website http://www.reduction-project.eu was launched in Month 1 of the project and provides the project's primary means of communication with the scientific community, other interested stakeholders and the public. The website provides information on the project's objectives and progress and is updated regularly to feature current and upcoming events. Publications are also regularly updated on the website

Coordination activities

In addition to the project meetings outlined above, the project partners maintained regular contact via telephone and ad-hoc WP meetings or informal meetings at scientific conferences. As part of the project's communication strategy, a project mailing list reduction-announcement@ismll.de was set up for communication within the project.

The password-protected groupware platform, in particular the interactive forum has also proved very effective in fostering good communication channels between project partners and work packages.

Cooperation with other projects / programmes

As outlined above, good contacts were established with the Euro-FOT project in December 2011. The REDUCTION consortium hopes to build on and expand these contacts with a view to further cooperation and exchange as the projects achieve maturity.

3. Deliverables and milestones achievement

3.1 Deliverables

TABLE 1. DELIVERABLES

Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level	Delivery date from Annex I	Actual / Forecast delivery date	Status	Contractual Yes/No	Comments
D7.1	Project website and fact-sheet	1	7	1. UHI	R	PU	30.09.2011	Month 1	Done	Yes	
D1.1	Report on the design and architecture of onboard technology and wireless communication technology	1	1	2. UTH	R	PU	29.02.2012	Month 6	Done	Yes	
D3.1	Report covering requirements specification, data-flow analysis and the system architecture	1	3	3. AAU	R	PU	29.02.2012	Month 6	Done	Yes	
D1.2	Report on advances in the development of onboard technology	1	1	5. DDE	R	RE	31.08.2012	Month 12	Done	Yes	

D1.3	Report on Packet Scheduling/Routing algoriothms	1	1	2. UTH	R	PU	31.08.2012	Month 12	Done	Yes	
D2.1	Report with data flow analysis and system architecture	1	2	6. TRI	R	PU	31.08.2012	Month 12	Done	Yes	
D2.2	Report on basic predictive analytics models	1	2	1. UHI	R	PU	31.08.2012	Month 12	Done	Yes	
D3.2	Report on eco-routing computation techniques	1	3	4. AU	R	PU	31.08.2012	Month 12	Done	Yes	
D3.3	Prototype basic eco route prediction	1	3	3. AAU	P	PU	31.08.2012	Month 12	Done	Yes	
D4.1	Report on initial requirements specification and conceptual framework	1	4	6. TRI	R	PU	31.08.2012	Month 12	Done	Yes	
D5.1	Report on collecting requirements and specification	1	5	3. AAU	R	PU	31.08.2012	Month 12	Done	Yes	
D6.1.1	First report on Dissemination	1	6	4. AU	R	PU	31.08.2012	Month 12	Done	Yes	
D6.2.1	First report on Exploitation	1	6	4. AU	R	PU	31.08.2012	Month 12	Done	Yes	

D6.3.1	First report on Contributions to Standards	1	6	5. DDE	R	PU	31.08.2012	Month 12	Done	Yes	
D7.2	First periodic report	1	7	1. UHI	R	PU	31.08.2012 + 60 days	Month 12 + 60 days	Done	Yes	

3.2 Milestones

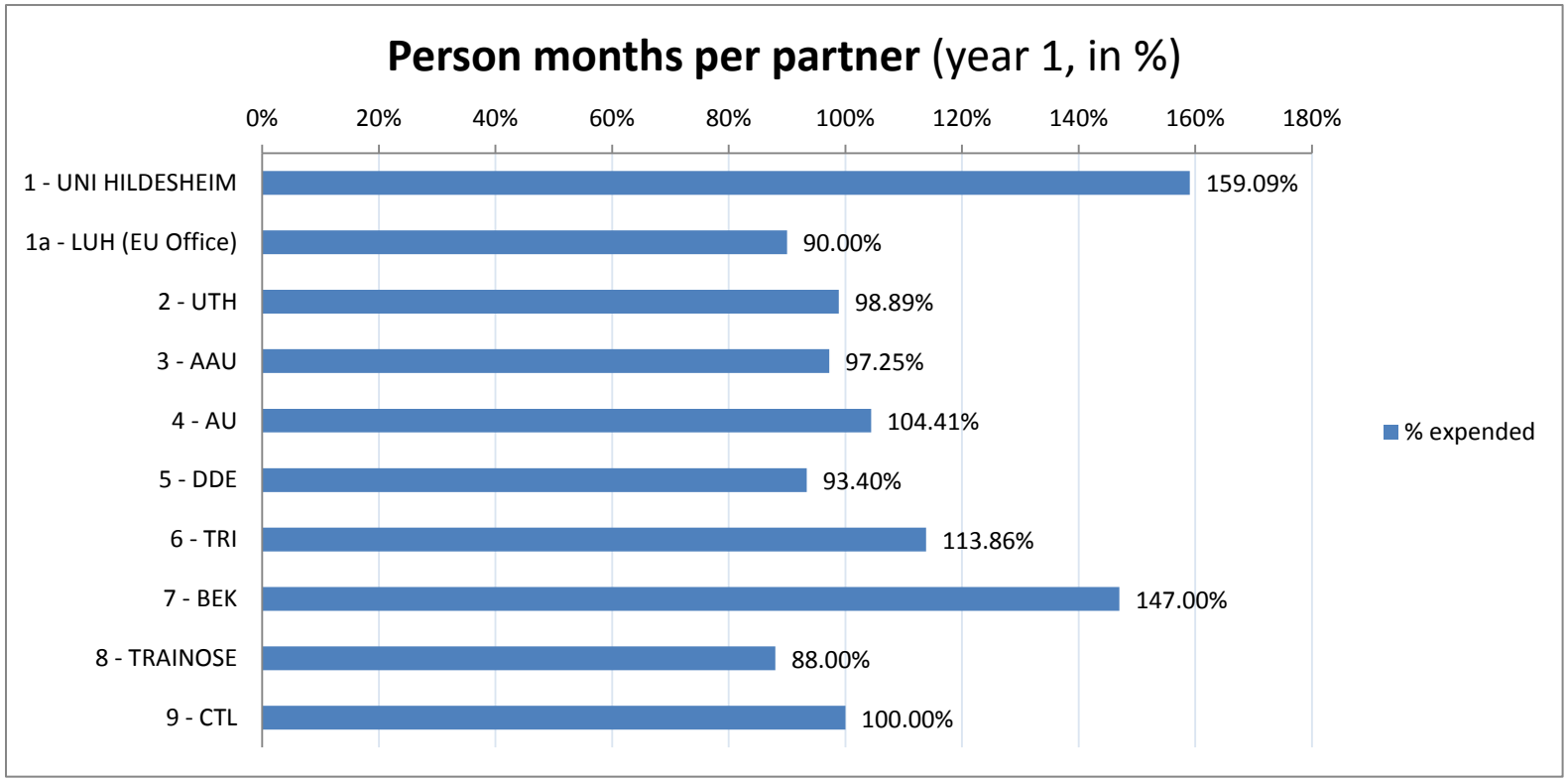
TABLE 2 MILESTONES

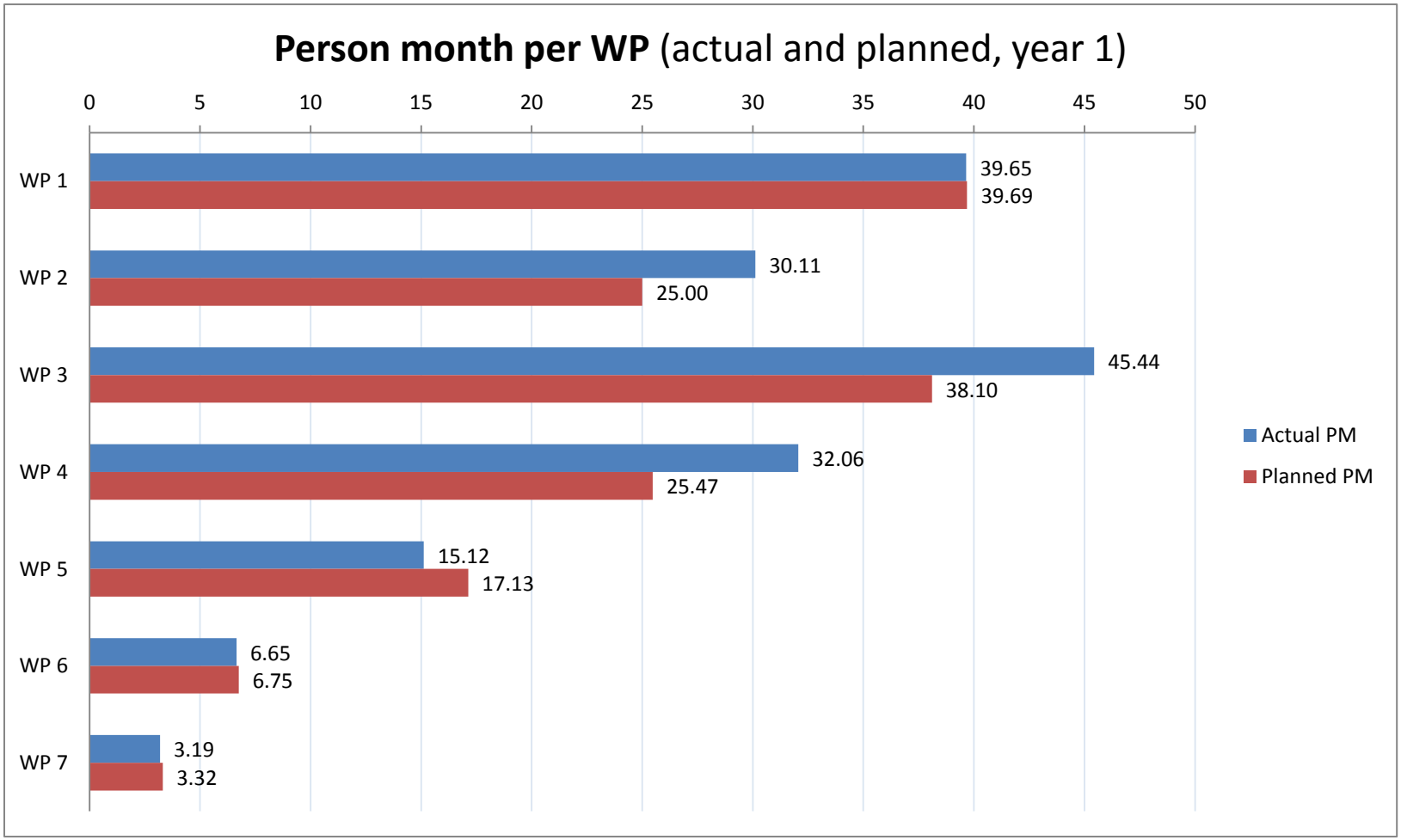
Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
M1	Requirements Collection and Initial Framework	WP 1, WP 2, WP 3, WP 4	6. TRI	Month 12	Yes	Month 12	

4. Explanation on the use of resources and financial statements

Total PM Expenditure for Year 1 (planned vs. actual)

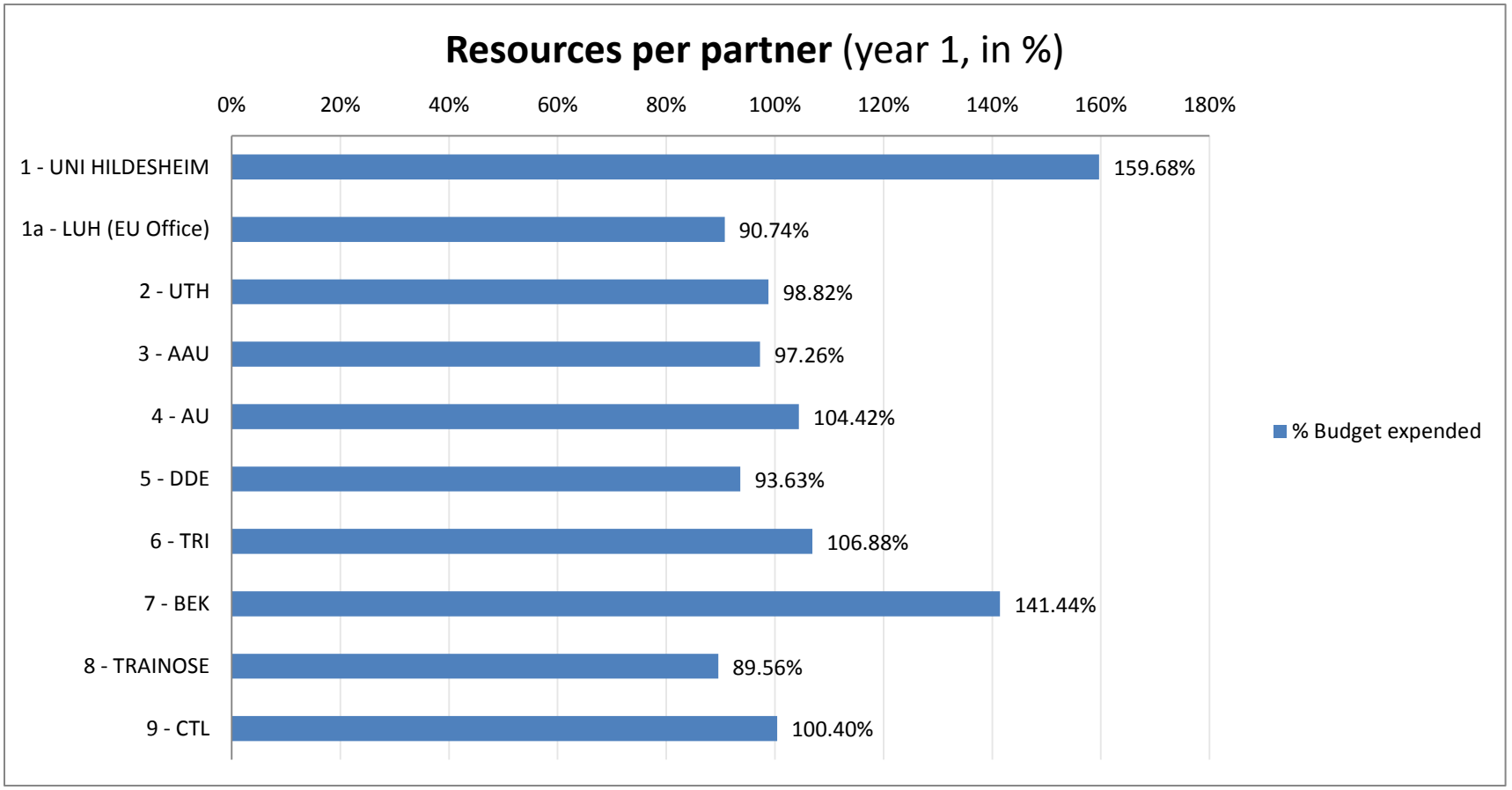
Person Months per WP and per Partner - Year 1													
			TOTALS	1 - UNI HILDESHEIM	1a - LUH (EU Office)	2 - UTH	3 - AAU	4 - AU	5 - DDE	6 - TRI	7 - BEK	8 - TRAINOSE	9 - CTL
WP1	Onboard Technology and Wireless Communication	Actual PM current total:	39,65	3,00	0,00	15,07	0,00	3,00	17,60	0,66	0,00	0,00	0,32
		Planned PM total duration:	39,69	2,00	0,00	15,07	0,00	3,00	19,00	0,30	0,00	0,00	0,32
WP2	Predictive Analytics Models for Energy-Efficient Driving and Driver-Behaviour Adaptation	Actual PM current total:	30,11	20,00	0,00	2,68	0,00	6,00	0,00	1,11	0,00	0,00	0,32
		Planned PM total duration:	25,00	14,00	0,00	2,68	0,00	6,00	0,00	2,00	0,00	0,00	0,32
WP3	Data Management for Environment Aware Routing and Geo-Locational Analysis Application	Actual PM current total:	45,44	3,00	0,00	3,28	11,65	20,50	0,00	0,81	5,88	0,00	0,32
		Planned PM total duration:	38,10	1,00	0,00	3,28	12,00	19,00	0,00	0,50	2,00	0,00	0,32
WP4	System Design & Integration	Actual PM current total:	32,06	4,00	0,00	2,08	0,09	2,00	0,00	23,59	0,00	0,00	0,30
		Planned PM total duration:	25,47	1,00	0,00	2,08	0,09	2,00	0,00	20,00	0,00	0,00	0,30
WP5	Case Studies for assessing Energy-Efficiency and CO2 Reduction	Actual PM current total:	15,12	3,00	0,00	1,71	0,35	3,00	0,00	0,00	0,00	5,28	1,78
		Planned PM total duration:	17,13	2,00	0,00	2,00	0,35	3,00	0,00	0,00	2,00	6,00	1,78
WP6	Dissemination, Exploitation, Standards	Actual PM current total:	6,65	2,00	0,00	0,00	0,25	1,00	2,20	0,90	0,00	0,00	0,30
		Planned PM total duration:	6,75	2,00	0,00	0,00	0,25	1,00	2,20	1,00	0,00	0,00	0,30
WP7	Project management	Actual PM current total:	3,19	0,00	1,80	1,00	0,02	0,00	0,00	0,37	0,00	0,00	0,00
		Planned PM total duration:	3,32	0,00	2,00	1,00	0,02	0,00	0,00	0,30	0,00	0,00	0,00
TOTAL PERSON MONTHS		Actual total:	172,22	35,00	1,80	25,82	12,36	35,50	19,80	27,44	5,88	5,28	3,34
		Planned total:	155,46	22,00	2,00	26,11	12,71	34,00	21,20	24,10	4,00	6,00	3,34
		% Expended	110,78%	159,09%	90,00%	98,89%	97,25%	104,41%	93,40%	113,86%	147,00%	88,00%	100,00%

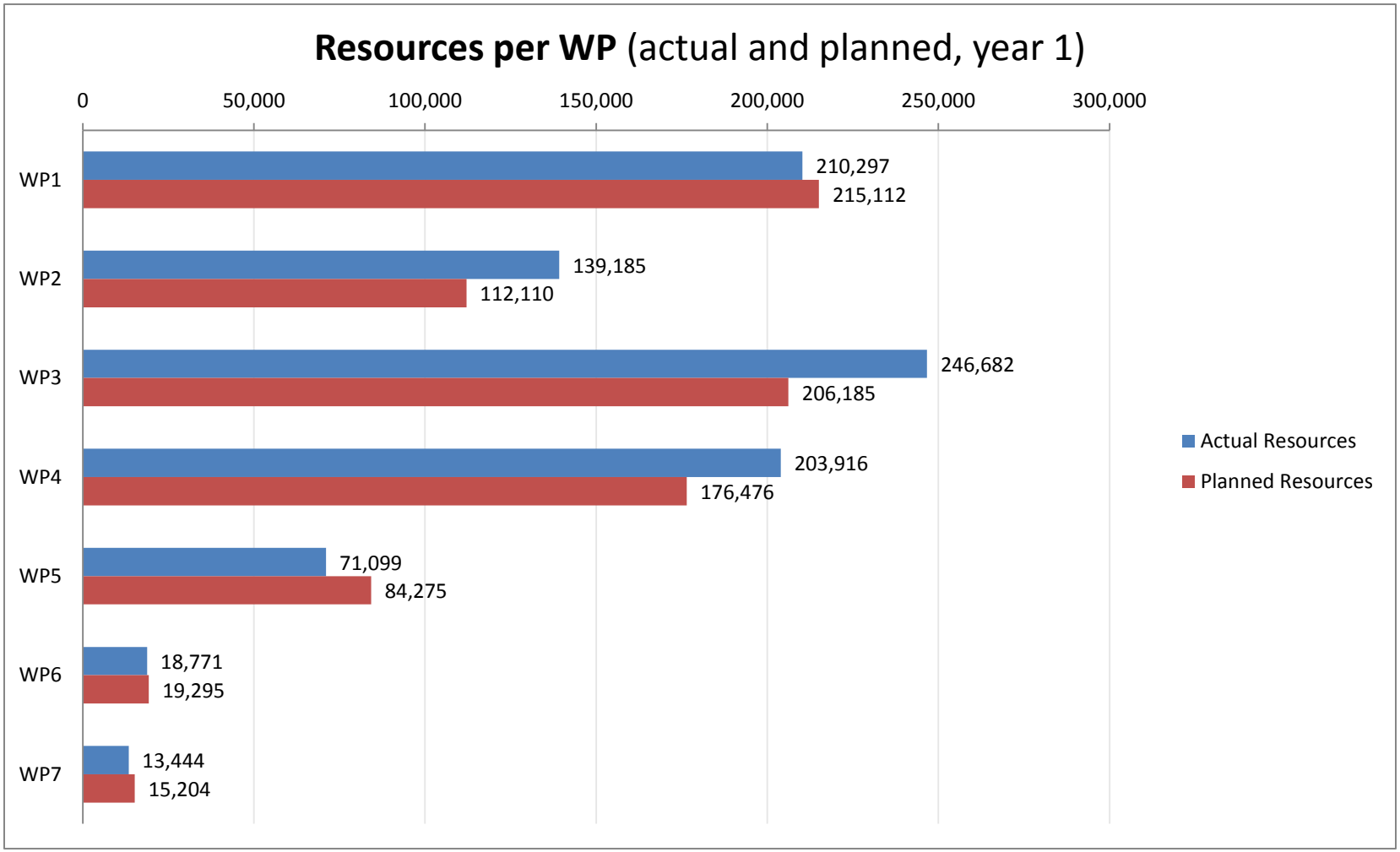

Person months per partner (year 1, in %)
0%
20%
40%
60%
80%
100%
120%
140%
160%
180%
1 - UNI HILDESHEIM
159.09%
1a - LUH (EU Office)
90.00%
2 - UTH
98.89%
3 - AAU
97.25%
4 - AU
104.41%
5 - DDE
93.40%
6 - TRI
113.86%
7 - BEK
147.00%
8 - TRAINOSE
88.00%
9 - CTL
100.00%
% expended


Person month per WP (actual and planned, year 1)
0
5
10
15
20
25
30
35
40
45
50
WP 1
39.65
39.69
WP 2
30.11
25.00
WP 3
45.44
38.10
WP 4
32.06
25.47
WP 5
15.12
17.13
WP 6
6.65
6.75
WP 7
3.19
3.32
Actual PM
Planned PM

Total Resources Expenditure for Year 1 (planned vs actual)

Resources (total expended costs) per WP and per Partner - Year 1													
			TOTALS	1 - UNI HILDESHEIM	1a - LUH (EU Office)	2 - UTH	3 - AAU	4 - AU	5 - DDE	6 - TRI	7 - BEK	8 - TRAINOSE	9 - CTL
WP1	Onboard Technology and Wireless Communication	Actual Resources current total:	210.297,00	15.212,00	0,00	30.223,00	0,00	22.436,00	136.701,00	2.914,00	0,00	0,00	2.811,00
		Planned Resources total duration:	215.112,00	10.142,00	0,00	30.223,00	0,00	22.436,00	146.000,00	3.500,00	0,00	0,00	2.811,00
WP2	Predictive Analytics Models for Energy-Efficient Driving and Driver-Behaviour Adaptation	Actual Resources current total:	139.185,00	84.430,00	0,00	9.000,00	0,00	35.743,00	0,00	7.201,00	0,00	0,00	2.811,00
		Planned Resources total duration:	112.110,00	59.556,00	0,00	9.000,00	0,00	35.743,00	0,00	5.000,00	0,00	0,00	2.811,00
WP3	Data Management for Environment Aware Routing and Geo-Locational Analysis Application	Actual Resources current total:	246.682,00	13.974,00	0,00	7.887,00	56.983,00	125.919,00	0,00	3.720,00	35.359,00	0,00	2.840,00
		Planned Resources total duration:	206.185,00	4.658,00	0,00	7.887,00	58.800,00	117.000,00	0,00	5.000,00	10.000,00	0,00	2.840,00
WP4	System Design & Integration	Actual Resources current total:	203.916,00	18.946,00	0,00	7.507,00	1.831,00	9.677,00	0,00	163.230,00	0,00	0,00	2.725,00
		Planned PM total duration:	176.476,00	4.736,00	0,00	7.507,00	1.831,00	9.677,00	0,00	150.000,00	0,00	0,00	2.725,00
WP5	Case Studies for assessing Energy-Efficiency and CO2 Reduction	Actual Resources current total:	71.099,00	13.978,00	0,00	9.600,00	3.072,00	16.847,00	0,00	0,00	0,00	17.464,00	10.138,00
		Planned Resources total duration:	84.275,00	9.318,00	0,00	10.400,00	3.072,00	16.847,00	0,00	0,00	15.000,00	19.500,00	10.138,00
WP6	Dissemination, Exploitation, Standards	Actual Resources current total:	18.771,00	9.168,00	0,00	0,00	2.595,00	0,00	0,00	4.312,00	0,00	0,00	2.696,00
		Planned Resources total duration:	19.295,00	9.100,00	0,00	0,00	2.595,00	0,00	0,00	5.000,00	0,00	0,00	2.600,00
WP7	Project management	Actual Resources current total:	13.444,00	0,00	7.441,00	2.880,00	124,00	0,00	0,00	2.999,00	0,00	0,00	0,00
		Planned Resources total duration:	15.204,00	0,00	8.200,00	2.880,00	124,00	0,00	0,00	4.000,00	0,00	0,00	0,00
TOTAL RESOURCES		Actual total:	903.394,00	155.708,00	7.441,00	67.097,00	64.605,00	210.622,00	136.701,00	184.376,00	35.359,00	17.464,00	24.021,00
		Planned total:	828.657,00	97.510,00	8.200,00	67.897,00	66.422,00	201.703,00	146.000,00	172.500,00	25.000,00	19.500,00	23.925,00
		% Expended	109,02%	159,68%	90,74%	98,82%	97,26%	104,42%	93,63%	106,88%	141,44%	89,56%	100,40%


Resources per partner (year 1, in %)
0%
20%
40%
60%
80%
100%
120%
140%
160%
180%
1 - UNI HILDESHEIM
159.68%
1a - LUH (EU Office)
90.74%
2 - UTH
98.82%
3 - AAU
97.26%
4 - AU
104.42%
5 - DDE
93.63%
6 - TRI
106.88%
7 - BEK
141.44%
8 - TRAINOSE
89.56%
9 - CTL
100.40%
% Budget expended


Resources per WP (actual and planned, year 1)
0
50,000
100,000
150,000
200,000
250,000
300,000
WP1
WP2
WP3
WP4
WP5
WP6
WP7
210,297
215,112
139,185
112,110
246,682
206,185
203,916
176,476
71,099
84,275
18,771
19,295
13,444
15,204
Actual Resources
Planned Resources

Explanation on the use of resources

In WP 2, 3, 4, more resources were needed than originally planned as additional effort has been put on getting CANBus and GNSS data, which has proven quite difficult to get and also the measurement of this metadata has also posed more difficulties than originally expected.

To compensate this lack, additional effort has been put in developing an alternative approach (see Risk Assessment section). In particular, a number of potential suppliers of CANBus data have already been contacted and negotiation about access to CANBus data is ongoing. Further, existing project that collects CANBus data have been contacted.

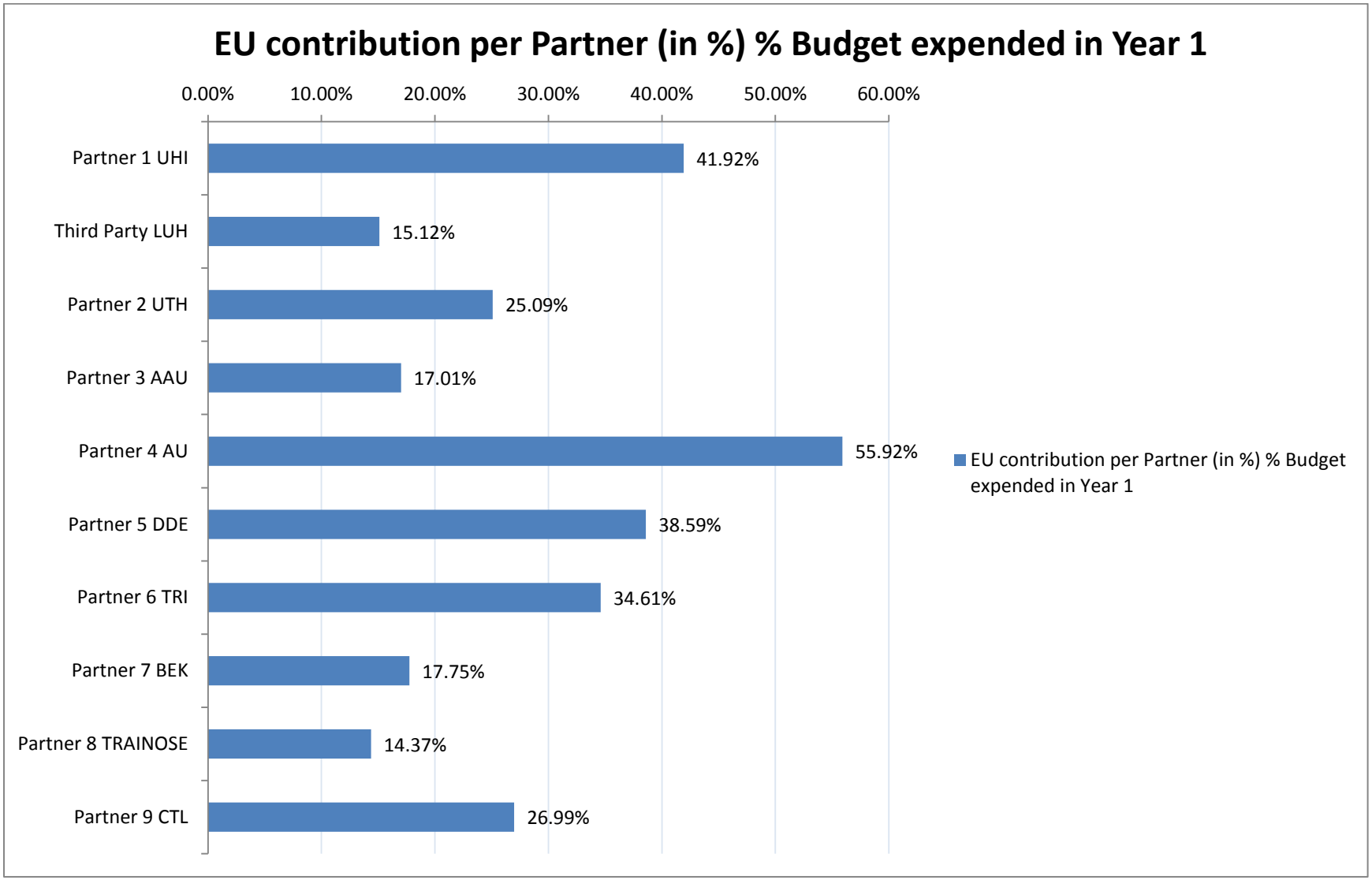
Financial statements – Form C and Summary financial report

Form C financial statements are being submitted for all partners in NEF.

Signed versions of all Form C statements will be submitted to the Commission by courier in parallel to the submission of the current report.

Total Budget Expenditure for Year 1 (Month 1 – 12)

		Total Budget acc. DOW				RP1 Reported				TOTAL Expended Year 1 + 2				TOTAL incl. Adjustments and Receipts	% Budget expended in Year 1+2
	Categories	RTD	MGT	OTHER	TOTAL	RTD	MGT	OTHER	TOTAL	RTD	MGT	OTHER	TOTAL		
Partner 1 UHI	TOTAL ELIGIBLE COSTS	479.384 €	91.100 €	0 €	**570.484 €**	232.323,00 €	14.668,00 €	0,00 €	**246.992,00 €**	335.726 €	35.086 €	0 €	**370.812 €**	370.812 €	**65,00%**
	EU CONTRIBUTION	359.538 €	91.100 €	0 €	**450.638 €**	174.242,00 €	14.668,00 €	0,00 €	**188.910,00 €**	251.794 €	35.086 €	0 €	**286.880 €**	286.880 €	**63,66%**
Third Party LUH	TOTAL ELIGIBLE COSTS	0 €	78.754 €	0 €	**78.754 €**	0,00 €	11.905,00 €	0,00 €	**11.905,00 €**	0 €	37.339 €	0 €	**37.339 €**	37.339 €	**47,41%**
	EU CONTRIBUTION	0 €	78.754 €	0 €	**78.754 €**	0,00 €	11.905,00 €	0,00 €	**11.905,00 €**	0 €	37.339 €	0 €	**37.339 €**	37.339 €	**47,41%**
Partner 2 UTH	TOTAL ELIGIBLE COSTS	403.200 €	23.100 €	0 €	**426.300 €**	102.747,00 €	4.608,00 €	0,00 €	**107.355,00 €**	229.411 €	7.640 €	0 €	**237.051 €**	237.051 €	**55,61%**
	EU CONTRIBUTION	302.400 €	23.100 €	0 €	**325.500 €**	77.060,00 €	4.608,00 €	0,00 €	**81.668,00 €**	172.058 €	7.640 €	0 €	**179.698 €**	179.698 €	**55,21%**
Partner 3 AAU	TOTAL ELIGIBLE COSTS	571.360 €	27.580 €	0 €	**598.940 €**	103.169,00 €	198,00 €	0,00 €	**103.368,00 €**	328.058 €	11.365 €	0 €	**339.424 €**	339.424 €	**56,67%**
	EU CONTRIBUTION	428.520 €	27.580 €	0 €	**456.100 €**	77.376,00 €	198,00 €	0,00 €	**77.574,00 €**	246.043 €	11.365 €	0 €	**257.408 €**	257.408 €	**56,44%**
Partner 4 AU	TOTAL ELIGIBLE COSTS	599.360 €	2.500 €	0 €	**601.860 €**	336.998,00 €	0,00 €	0,00 €	**336.998,00 €**	667.351 €	0 €	0 €	**667.351 €**	667.351 €	**110,88%**
	EU CONTRIBUTION	449.520 €	2.500 €	0 €	**452.020 €**	252.748,00 €	0,00 €	0,00 €	**252.748,00 €**	500.513 €	0 €	0 €	**500.513 €**	500.513 €	**110,73%**
Partner 5 DDE	TOTAL ELIGIBLE COSTS	607.505 €	0 €	0 €	**607.505 €**	234.436,00 €	0,00 €	0,00 €	**234.436,00 €**	413.124 €	0 €	0 €	**413.124 €**	413.124 €	**68,00%**
	EU CONTRIBUTION	303.753 €	0 €	0 €	**303.753 €**	117.218,00 €	0,00 €	0,00 €	**117.218,00 €**	206.562 €	0 €	0 €	**206.562 €**	206.562 €	**68,00%**
Partner 6 TRI	TOTAL ELIGIBLE COSTS	598.400 €	27.900 €	0 €	**626.300 €**	215.313,00 €	3.485,00 €	0,00 €	**218.799,00 €**	315.167 €	6.245 €	0 €	**321.411 €**	321.411 €	**51,32%**
	EU CONTRIBUTION	448.800 €	27.900 €	0 €	**476.700 €**	161.484,00 €	3.485,00 €	0,00 €	**164.969,00 €**	236.374 €	6.245 €	0 €	**242.619 €**	242.619 €	**50,90%**
Partner 7 BEK	TOTAL ELIGIBLE COSTS	199.200 €	0 €	0 €	**199.200 €**	35.359,00 €	0,00 €	0,00 €	**35.359,00 €**	60.530 €	0 €	0 €	**60.530 €**	60.530 €	**30,39%**
	EU CONTRIBUTION	149.400 €	0 €	0 €	**149.400 €**	26.519,00 €	0,00 €	0,00 €	**26.519,00 €**	45.398 €	0 €	0 €	**45.398 €**	45.398 €	**30,39%**
Partner 8 TRAINOSE	TOTAL ELIGIBLE COSTS	121.500 €	0 €	0 €	**121.500 €**	17.464,00 €	0,00 €	0,00 €	**17.464,00 €**	33.675 €	0 €	0 €	**33.675 €**	33.675 €	**27,72%**
	EU CONTRIBUTION	60.750 €	0 €	0 €	**60.750 €**	8.732,00 €	0,00 €	0,00 €	**8.732,00 €**	16.837 €	0 €	0 €	**16.837 €**	16.837 €	**27,72%**
Partner 9 CTL	TOTAL ELIGIBLE COSTS	142.400 €	0 €	0 €	**142.400 €**	38.430,00 €	0,00 €	0,00 €	**38.430,00 €**	93.856 €	0 €	0 €	**93.856 €**	93.856 €	**65,91%**
	EU CONTRIBUTION	106.800 €	0 €	0 €	**106.800 €**	28.822,00 €	0,00 €	0,00 €	**28.822,00 €**	70.392 €	0 €	0 €	**70.392 €**	70.392 €	**65,91%**
TOTAL	**TOTAL ELIGIBLE COSTS**	3.722.309 €	250.934 €	0 €	**3.973.243 €**	1.316.239,00 €	34.864,00 €	0,00 €	**1.351.106,00 €**	2.476.899 €	97.674 €	0 €	**2.574.573 €**	**2.574.573 €**	**62,99%**
	EU CONTRIBUTION	2.609.481 €	250.934 €	0 €	**2.860.414 €**	924.201,00 €	34.864,00 €	0,00 €	**959.065,00 €**	1.745.971 €	97.674 €	0 €	**1.843.645 €**	**1.843.645 €**	**62,72%**


EU contribution per Partner (in %) % Budget expended in Year 1
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
Partner 1 UHI
41.92%
Third Party LUH
15.12%
Partner 2 UTH
25.09%
Partner 3 AAU
17.01%
Partner 4 AU
55.92%
Partner 5 DDE
38.59%
Partner 6 TRI
34.61%
Partner 7 BEK
17.75%
Partner 8 TRAINOSE
14.37%
Partner 9 CTL
26.99%
EU contribution per Partner (in %) % Budget expended in Year 1

5. Certificates on the Financial Statements

Beneficiary	Organisation short name	Certificate on the financial statements provided? yes / no	Any useful comment, in particular if a certificate is not provided
1	UHI + LUH (SC 10)	No	EC contribution under threshold, no CFS required
2	UTH	No	EC contribution under threshold, no CFS required
3	AAU	No	EC contribution under threshold, no CFS required
4	AU	No	EC contribution under threshold, no CFS required
5	DDE	No	EC contribution under threshold, no CFS required
6	TRI	No	EC contribution under threshold, no CFS required
7	BEK	No	EC contribution under threshold, no CFS required
8	TRAINOSE	No	EC contribution under threshold, no CFS required
9	CTL	No	EC contribution under threshold, no CFS required

6. Risk Assessment

WP 1 Onboard Technology and Wireless Communication

Task 1.1 Design and architecture and Task 1.3 VANET Packet Scheduling / Routing and Information Dissemination

The failure to have OBU's installed on vehicles on the field trials, in order to implement the Reduction vehicle routing algorithms is at low risk. Field trials are used in order to evaluate the accuracy of our methods but do not affect the designing of them. In case where no field trial can be performed in real time, simulation frameworks like Ns3 or OMNET++ in combination with road traffic simulation packages like SUMO can be used in order to evaluate the performance of the new routing methods. Off line GPS data can also be used in order to simulate real traffic scenario's and test the performance of our communication protocols. The Reduction project finally has access to approximately 370 million measurements from 120 vehicles with a total 500,000 trips.

Task 1.2 Onboard Technology

The improvements report reflects the modifications done to the previous default DELPHI CCU which was deemed unfit to sustain the REDUCTION needs as described in the proposal. Also during later meetings of the REDUCTION consortium more substantial user needs were supplied by partners. That info ultimately leads to the current version of the hardware.

Modifications & Improvements:

- improved CPU speed (to 1GHz from 500 MHz)

- improved RAM size (from 256MB to 1GB)

- user SSD with 4GB storage space for various logs (e.g. CAN/GPS data logs)

- High-Speed CAN now supplied instead of optional

Coming from various projects (ASIA, EU, US, and DELPHI internal) the former DELPHI CCU hardware was a laboratory-platform for various projects/scenarios and implementations. It had been designed with scalability and flexibility in mind rather than mass-market deployment feasibility.

However, with time progressing lots of experience was gathered in this field and therefore also progress in the maturation of the hardware design.

The addressed modifications were needed to be done in order to move from a laboratory-like prototype to a more robust design which is able to endure in a demanding automotive environment.

WP 2 Predictive Analytics Models for Energy-Efficient Driving and Driver-Behaviour Adaptation

Both sets of methodologies, regarding Distributed Data Mining and Eco-Driving are already implemented and functional. There are no current (or expected) deviations from the objectives of DOW and the time-frames. The synthetic data for the distributed data mining is already generated, while data related eco-driving is possessed and is expected to be enriched by CTL use-case.

The lack of CANBUS data for the WP2 use-case is already addressed by proposing methods that operate using GPS data. The GPS data are more widely available than CANBUS messages, because vehicles already possess devices that record logs of their position across travels. As a consequence of the large distribution of GPS data and their abundance, the price of GPS data (both acquisition/recording) are comparably low. In addition, the method proposed in Deliverable 2.3.1 can mines local driving behaviors from GPS traces. Therefore, no deviations are expected in terms of data availability as well.

Large scale experiments on V2V scenario will not be possible because of the limited number of buses in the Nikosia field study and the limited instances of the onboard devices produced by Delphi in the scope of WP1. However, the project plans to mitigate this situation by (i) conducting proof-of-concept experiments in the Nikosia buses, and (ii) running large scale experiments on simulated environments in order to test both advantages and limitations of distributed statistical models. The accuracy of the distributed statistical models can be tested and assessed by the results of the simulations, therefore no objective or time deviations are expected for the methods proposed by WP2.

WP 3 Data Management for Environment Aware Routing and Geo-Locational Analysis

Task 3.1 Requirement specification and Software architecture

System Boundaries

The system specified interacts with a number of other systems.

- The trip scheduling system. This system is responsible for the best utilization of a fleet of vehicles that is controlled by a single traffic coordinator. Data from multiple trip scheduling systems may be received.
- The timetable system. This system can be queried for travel-time information between a start point and a destination. Alternative timetable system can be used, e.g., one for bus transport and another for train transport.

Limitations

The known limitations of the system include the following.

- The system only supports road transport, i.e., no support for air or sea transport. The reason is that air and sea transport is significantly different from road transport.
- The system only considers transportation of passengers. As an example, the transportation of

freight is not considered. The main reasons for focusing on the transportation of passengers is use cases in WP5 will solely look at passenger transport and that the requirements are very different from transportation of freight, e.g., passengers cannot be stored in a warehouse, requires as seat, and cannot be made to change vehicle a large number of times.

- The system only supports road vehicles with combustion engines, i.e., electrical or hybrid cars and trucks are not considered (electrical busses, trams and trains are supported). The main reason is that the number electrical or hybrid cars is still very low.
- The system only supports the GPS because this is the only GNSS in widespread usage. Extending the system to support the Galileo or the GLOSNASS GNSS, should be fairly straight forward. However, no GNSS measurements from these Galileo or GLOSNASS GNSSs have been available when the system has been designed.
- The system will not support traffic information from sources such as number plate recognition systems, Bluetooth detection systems, or induction loops. These sources do not allowed the accuracy of determining the actual trips as GNSS measurements do. In addition, the integration of these additional sources will require a major effort, which will not add additional functionality to the system.
- The focus in the prototype is to support car and taxi data. However, there cannot be made design of implementation decisions that prevents other vehicles types, e.g., trucks and busses from supplying data to the platform. The reason for this limitation is that at the time of design only GNSS measurements from cars and taxis are available.
- The system has no information about the drivers of the vehicles. The reason for this limitation is that such functionality can be considered monitoring and tracking individual persons.

Task 3.2 Basic eco-routing methods

Eco-Routing computation techniques

The failure to acquire CAN-BUS data has been identified as low risk, because it was always something to be used for the evaluation of the accuracy of our methods, but not a core component in the methods itself. Our algorithms are purely designed based on raw GPS trajectories and hence can be built independently of CAN-BUS data.
Our EcoMark benchmark allows us to compare various fuel computation models and chose the ones that suit our scenarios the best. We intend to use relative fuel costs to understand how the eco-routes compare to one another.
We also identified that our solution caters only to passengers and does not take into account freight transportation.

Prototype Basic Eco-Route Techniques

There are several open issues that should be solved before or during the BeKTra/FlexDanmark field trials:

- As mentioned in the format of the CANBus data supplied to the REDUCTION project is not

exactly known at the time of writing. However, it is clear that values engine RPM, throttle position (in percentage), and current fuel consumption can be supplied. The CANBus data currently available to the REDUCTION project is a number of different formats and the prototype therefore does special handling of each case. This is not a solution that scales well.

- There are a number of parameters that must be specified for the Time-to-Eco and Trajectory-to-Eco algorithms. The value of these parameters must be found as part of the experimentation in the first field trial and verified/adjusted in the second field trial.
- There are also a number of weights to be specified for the weighted approach to compute eco-routes. These weights are currently specified using a qualified guesswork. The first field trials should make it possible to find reasonable values for the weights. This included that there may be different set of vectors for each road category or even more refined for each road category in each region.
- To deal with the lack of CANBus data it has be examined if other funded projects can provide access to CANBus data. In particular, has the FP7 project *EuroFOT* [15] been studied because this project has created and collected very large numbers of both GNSS measurements and CANBus data. Unfortunately, the REDUCTION project cannot get access to this data due to "ensure privacy, respect IPR, avoid benchmarking, maintain reasonable information content" [16] page 9. If the REDUCTION project cannot supply sufficient GNSS measurements and CANBus Data before the second BeKTra/FlexDanmark field trial perusing access to the access to EuroFOT data at the REDUCTION project level can be considered.
- The proto-type presented here computes the estimated fuel consumption for driving a trip. It can be consider that the GHG emission for a trip should also be estimated. To do this a number of existing approaches can be used [17]. It is fairly straight forward to include such additional GHG emission estimates when the basic fuel consumption has been estimated. The field trials and feedback from the companies should determine if these additional estimates are needed.

We expect that all risks can be resolved during the field trials.

WP 4 System Design and Integration

Task 4.1 Requirement specification and software architecture

The problem we are facing in this task is also the difficulty to get CANBus data. In case we cannot directly get the measurment data from CANBus data, Fuel consumption model and CO2 emission model which have been investigated in WP4 will be used to estimate fuel consumption and CO2 emission.
The methods for estimating fuel consumption and GHG emission have been developed for several years. In the context of road transportation, Fuel consumption and GHG emission models are classified into macroscopic and microscopic models in. The models are a good alternative source to get the CANBus data based on GPS data.

WP 5 Case Studies for assessing energy-efficient and CO 2 reduction

Task 5.1 Initial requirements collection and Task 5.2 Field Trials in Phase 1: Field trial for BEK (AAU, BEK)

There are a number of open issues that the first field trial must consider such that it in the best case can be eliminated for the second field trial. For the BeKTra/FlexDanmark field trials these issues are the following:
What is the unit for the eco-route estimate?
Work-around:

- Use only actual CANBus measurements where milliliter fuel can be read directly.
- Use relative instead of absolute units. With relative units it is still possible to estimate which route is the most eco-friendly.

Can sufficient CANBus data or high-frequency GNSS data be provided such that an eco map can be created that is accurate?

- Work-around: Use smaller geographical area in field trials, i.e., where sufficient data is available.

Can eco route be computed fast enough to allow for interactive sessions?

- Work-around: If not then it must be explored how a less precise result can be computed using faster approaches, e.g., by precomputing at a course geographical granularity.

Can outliers destroy the estimation of eco-routes?

- Work-around: If a few drivers are clearly not behaving as expected GNSS and CANBus measurements from the vehicles driven by these drivers will be removed.

It is the assessment that all of these issues can be resolved or work-arounds found.

WP 6 Dissemination, Exploitation, Standards

The first results in the project which can be intensively exploited and disseminated will be available in the 3rd year of the project so that we have the risk that during the 1st and 2nd year of the project less exploitation and dissemination activities can take place.

To adjust this risk the consortium has agreed to discuss this issue intensively during project meetings and intensify communication along the duration of the project in order to write publications together and plan dissemination activities.

WP 7 Project management

The timely submission of the 1st Periodic Report is a challenge / risk factor because at the end of the 1st year of the REDUCTION the work load for each partner is quite high due to 2 factors:

- 12 scientific deliverables are due at the end of the 1st year
- The first technical review and preparations for the review are taking place during the 60

days period for the preparation of the Periodic Report

To overcome this risk the partners have found two solutions so far:

- Planning the technical review at the very end of the 60 days preparation period for the Periodic Report
- Steering Committee meetings taking place in a two-week turn so that the partners can quickly discuss issues concerning reporting, finances etc.

7. Conclusion

In the first year of the project the coordination team has established monitoring and communication structures within the consortium.

Controlling of budget and Person Months resources has been established and carried out. The tables with overviews of resources planned vs actual have been integrated in the EC Periodic Report 1.

Quarterly reports have been implemented to monitor the progress of the scientific work and to serve as background for writing the EC periodic report.

Deliverables and milestones have been achieved mostly at the deadline set in Annex I; when delays in the delivery have occurred, the Project Officer has been informed.

A detailed risk assessment for each work package has been written and included in EC Periodic Report.

Steering Committee meetings have been organized on a quarterly basis in order to facilitate scientific progress and communication within the consortium. The topics discussed per meeting have been included in this report.

A risk identified by the consortium during the first year of the project is the timely submission of the 1st Periodic Report as at the end of the reporting period the consortium also needs to submit 12 deliverables and prepare for the technical review with the European Commission. The work load on the consortium is therefore very high. The consortium is planning on minimizing this risk by two-weekly telephone conferences during the period of preparation of the deliverables in order to facilitate quick exchange of information among the partners.

8. Glossary

CAN	Controller Area Network
DSRC	Dedicated Short Range Communication
GNSS	Global Navigation Satellilte System
GPS	Global Positioning System
ITS	Intelligent Transportation Systems
NWT	Network & Transport
PHY	Physical Layer / Access
SSD	Solid State Disk
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
VANET	Vehicular Ad-Hoc Network
WiFi	Wireless Fidelity

9. Table of Figures

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