

“Vehicular Remote Tolling” (VeRT)

Introduction

The road sector is one of the major potential market for GNSS applications and therefore for EGNOS/GALILEO. GPS satellite navigation receivers are now commonly installed in cars as a key equipment for providing appealing services to people on the move such as route guidance, remote assistance, thief's protection and fleet management.

The availability of EGNOS (from April 2004 it will be fully operational) will enable the implementation of other services like: electronic charging, real time traffic information, emergency calls, active route guidance, Hazmat transportation or Advanced Driving Assistance Systems. In fact these new applications, for their specific nature, must rely on a more precise and guaranteed navigation signal, characteristics that are not reflected by the GPS.

At present, traffic congestion places enormous constraints on our day-to-day mobility with over 10% of the network blocked, representing enormous costs. Improving road transport systems calls for systematic recourse to information about vehicle position and speed. A driver using an EGNOS or GALILEO receiver will be able to determine his location and find the best route with a better precision and reliability than ever, thanks also to the foreseen interoperability between GPS and GALILEO.

The Project VeRT aims at exploiting the capabilities offered by EGNOS (in the near term) and GALILEO (in medium long term) to provide such new applications; specifically, an extended service concept of road tolling is addressed in the present proposal, herein after indicated as “remote tolling”, such to cover basic tolling service, but also additional “pay-per-use services” on motorways transport, as well as in urban environment (parking and access to restricted zones)

The VeRT project is co-funded by the EC under the initiative of the 1st Call of the GALILEO Joint Undertaking.

Objective of the present project is to exploit the capabilities offered by EGNOS and GALILEO to provide new applications in the road sector. These new applications will include: basic tolling service, but also additional “pay-per-use services” on motorways transport, as well as in urban environment (parking and access to restricted zones).

The project will be conducted by an industrial consortium led by the:

Gavio Group (Sinelec, Autostrada dei Fiori, SALT, ASTM TLC, Autosped, Parcheggi Italia, Unitra),

with the participation of:

Comune di TORINO, Pagnanielli Risk Solution Ltd , Renault Trucks, Alenia Spazio, Universita' di Tor Vergata, AALBORG University, EDISOFT, MTA-SZTAKI, AAT Ltd, BAIN & Co and NEXT-Ingegneria dei Sistemi SpA

The INSTANT technology

The VeRT service provision prototype will make reuse of the INSTANT Infrastructure Technology developed in the frame of the 5th framework programme of EC. This choice will allow to reduce the cost of the demonstrator focusing the attention to the service provision aspects according to the GJU call objectives.

The system that will be used for on site demonstration is depicted in the following figure, in which are shown the User Terminals (car units) and the Service Control Centre.

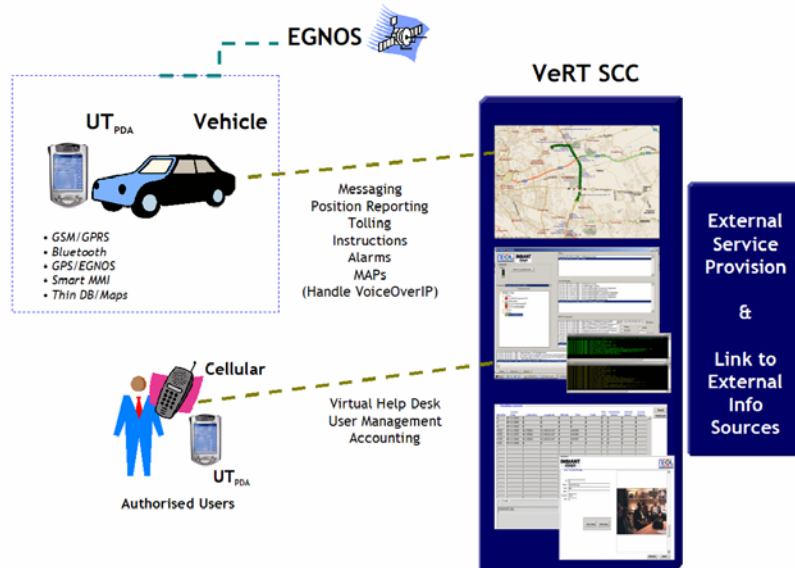


Fig. 1: VeRT Service View

The system, as delineated above, will be based on the INSTANT system (see below), that for specific applications (e.g. Safety of Life, Emergencies Services) uses a mobile service deployment by means of the MCC (Mobile Control Centre), used to operate a local control of the operation, maintaining a safe connection (i.e. SatCom) with the SCC.

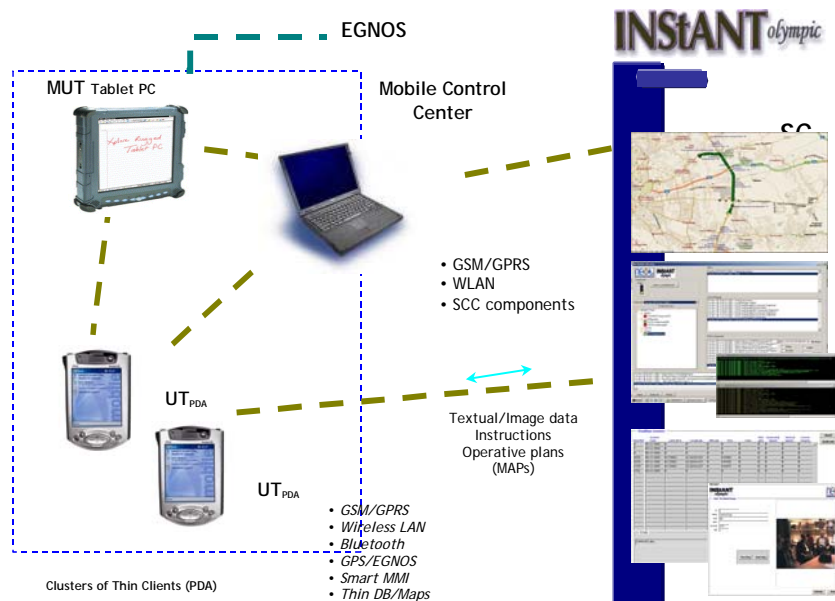


Fig. 2 : INSTANT system view

The following, taking into account the Figures 6 and 4 above, is an overall description of the VeRT Service Prototype architecture together with its major functionalities:

User Terminals: VeRT user terminals will be based on standard handheld/tablet devices (or similar), capable of the following:

- GNSS navigation and positioning based on EGNOS receivers (i.e. Bluetooth or integrated devices) – SisNet integration will be also possible;
- GSM/GPRS/SatCom communications;
- Smart MMIs: such man machine interfaces will allow the user to log securely into the VeRT system (transparently or intentionally, depending on the Service Models actually used), to inform the user of the billing status, its accounting rules and status, to perform the functionalities that the system will offer depending on the context (e.g. entering in a tolled motorway, confirm the accounting rule, to notify alarms, to allow booking, etc.) and to let the exchange multimedia messages with other logged users and/or to the VeRT Virtual Help Desk (or to browse the Internet), acknowledge of request, service consumption status, credit card payment receipt, etc. The mechanism offered by the INSTANT infrastructure is providing an effective way to manage and reconfigure the MMI in a context/functionality depended fashion (i.e. using an XML interpretive mechanism).
- Mapping: INSTANT reuse of the open mapping mechanism (based on OpenGIS platforms) will allow to the user to map itself on the road network, to use dynamically route guidance and to show (and handle) real-time traffic information.
- Data Storage and Service Back-end capabilities: to allow the management of archiving and logging of data and to handle the service models and functionalities (e.g. allowing secure repository of crypto keys)
- Event Management and improved (secure) Request Broker: to easily integrate with the INSTANT infrastructure (reused).
- Service Control Centre, that will be used as support to existing Legacy Centres for the specific services.

Service Control Centre:

- Web services: based on Application Server allows the management of the service provisioning –connecting users, giving the opportunity to have a centralised VeRT information Service. This includes a (reused) Device Mapper capability, to allow the connection to a broad range of mobile devices such as Mobile Cellular Phones and standard (non equipped) handheld devices (this will allow to extend a degraded service to the mass market users)
- Event Management and Messaging: these components will aim to a scalable event management and messaging capabilities and to connect VeRT user terminal. The capability of the infrastructure components to be deployed in a GRIDDED network will allow the system to face SERVICE ORIENTATION – scalability and robustness among others.
- Security and QoS management: to allow secure messaging, handling of information and optimisation of Quality of Service features (such as dynamic bandwidth allocation). Java platform on the User Terminals will allow to use Security Management with specific platforms such as (JASS and JCE, see below)
- Command and Control: to allow the Service Provider to manage real-time operations and partial failures of the system
- Fleet Management and Route Guidance: reuse and improvement of a secure and scalable fleet management and a traffic integrated, EGNOS resolution capable, Route Guidance will allow the optimal usage within the envisaged Motorway and Urban Environment services.

- Service Database and Service Data Modeler: the usage of a centralised, application oriented, DBMS (such as Oracle) will allow with a minimal improvement to store and handle all the event management, storing, archiving, logging, publication of the needed Service Prototype activities. The reuse of the parameterisation capabilities, in a visual form, of the INSTANT Application Data Modeler will allow the dynamic reconfiguration of all the parameters need for modelling a specific service (i.e. Event types, Alarms, Notifications, Profiling, etc.).
- User Access Control Service: as the core part of the Service Manager, this component will allow the management of the Service Users – making capable the VeRT service to be securely and massively accessed by external authorised users. Among other components the User management (), the Partner management (), the Accounting management (), the Fraud management are key basic functionalities to be built for the VeRT Service Prototype. A simple secure Access Control System, a profiling mechanism and a User DB are available in the infrastructure. Billing mechanism, where is computed the amount of money (invoice) due for each user according to the selected payment scheme (road tolling per km, parking per time etc.) and mechanism (yearly subscription, daily/hourly fee. etc.), is also included.
- GIS: it will contain Routes, Geo-referenced real time data with special facilities for the scoped location based services (e.g. virtual entrances and tolling points). Digital maps of the interested areas are also widely used.
- Road tolling management and accounting algorithms , Parking management and accounting algorithms are included in the Service management