Value added services

A 'mini-zone' trialling value added services using tag and beacon technology has provided an insight into the future of congestion charging. The different elements of this challenging technical puzzle talk to **John Glen** from Mott Macdonald about the parts they played in this ground-breaking trial.

The trial zone was established south of the Thames in Southwark, London

As you drive into a congestion charging zone, your hands free phone rings to give you information on special events that day and traffic conditions within the zone. Later on, a phone call may remind you that the charge is still due and tell you what payment systems are available to you. Visitors to the ITS World Congress were able to experience these value added services at the Transport for London (TfL) exhibit.

The idea of trialling value added services was conceived within the Congestion Charging Directorate. A trial zone was established south of the Thames, and charge points using tag and beacon technology (DSRC technology) were established at locations across this so-called 'DSRC mini-zone'.

The DSRC mini-zone trial provided accurate information on location, tag ID, direction of travel and time of transit for each test vehicle as it passed through the charge point, and this was used to trigger the delivery of value added services to demonstrate the integration of the transactional VAS developed in Stage 1 (along with further refinements) with the DSRC system being trialled.

One aim of the trials was to demonstrate how in-car authentication could be carried out using Bluetooth technology. The objective of DSRC tag and beacon technology is ultimately to generate a charge for the passage of a vehicle. The trials sought to demonstrate how this might be done, with charges that varied by time of day, direction of travel, site location, and the generation of customer bills.

All the above applications rely on accessing and manipulating customer data. The last segment of the Stage 2 VAS trials therefore aimed to demonstrate the setting up of a customer database, its operation and integration with the VAS trials

A number of companies combined to deliver the trials – Mott MacDonald, CablesEdge, MapFlow, ixPocket and XCD Communications. SEA was engaged to define the implementation requirements and to test the delivered system. IPL also had a role in assessing some of the telecommunications issues. Each company contributed as follows:

Mott MacDonald, by Fraser Macdonald

Mott MacDonald's role in this trial was developing the overall software architecture, including server and client components. This work involved specifying the integration of the elements being provided by others, and defining and maintaining a unified database model.

The software team also developed a customer registration subsystem and flexible billing subsystem. The billing system allows TfL to test a number of charging scenarios, such as variable charging based on time and location. The billing system also implements an accelerated time mode, allowing TfL to simulate multiple charging days within a single calendar day. This greatly increased the number of trial journeys that could be performed and scenarios that could be explored within a shorter time span.

Mott MacDonald adopted a phased approach to system delivery, initially defining three releases, each of which delivered increasing functionality. Each delivery was hosted by Mapflow after a period of acceptance testing by SEA. The phased approach helped manage the complexities of integrating software from the four companies. It also provided TfL with opportunities to revise and refine, as well as early confidence that the system could be successfully delivered.

CablesEdge, by Lisa Suutari

CablesEdge provides TfL with safe, hands-free voice access to drivers in the congestion zone and throughout London with its Voice on the GoTM platform. Voice on the GoTM is a unique voice (and data) solution to manage user requests and deliver information through interactive voice commands. Drivers access traffic, news or congestion charge account information through their existing mobile phone – no special devices or download is required. Drivers receive traf-

fic alerts, charge information and news, whilst in the zone, or payment reminders after exiting, all through clear and safe audio calls.

For TfL, CablesEdge modelled driver voice interactions in English and Urdu to automatically call drivers to alert them of charges when entering the congestion zone, payment reminders for outstanding acc-ounts, news and traffic updates. Drivers can simply call the TfL VAS information system at any time for up-to-date information. Simple commands and the ability to interrupt and direct the system keep interactions quick and easy. Voice on the GoTM recognises any voice with no user training.

CablesEdge also designed and delivered the VAS core logic platform to manage inputs from charge, traffic, news and billing systems, and deliver value added services according to driver preferences and whereabouts. Overall, the Voice on the GoTM platform provides a scalable framework for delivery of this and other data to drivers in a safe and effective manner.

MapFlow, by John Wills

Mapflow provides the hosting and ongoing management of TfL's VAS platform. This includes managing the receipt of information on DSRC (tag and beacon) or GPS charging events, processing those events and delivering the resulting SMS and voice calls to VAS users. Mapflow also maintains connectivity between all the elements and ensures all data is logged for subsequent performance analysis.

For TfL's GPS-based VAS and distance-based charging trials, Mapflow also provided the map-matching capability needed to convert GPS data into road charging information. By combining maps of road geometry with vehicle manoeuvres from GPS data, map matching filters out misleading GPS data and bridges periods when satellite signals were obscured or even missing. Map-matching provides a list of road segments used during a journey, with each segment time stamped according to when it was driven. This information can then be passed to billing systems to calculate the appropriate charge for journeys. In London's challenging built environment, map-matching is essential for effective distance-based charging.

ixPocket, by Eric Donovan

ixPocket developed the mobile phone software to deliver the VAS to congestion charge users via their phones, using its experience of the mobile handset market to evaluate current technologies and the various capabilities that would be available to users in the near future.

Due to the relatively high turnover of new mobile devices, even during the timescales of the project more capabilities became available, opening up more potential services.

Together with the rest of the trials team, a design was thrashed out that met TfLs requirements in a number of mobile technologies including wireless Java and SIM toolkit. The handsets were sourced and ixPocket implemented, deployed and tested the mobile software components of the system. The final cut of the mobile software includes building block capabilities that enable secure encrypted communication over SMS or GPRS; applications that can be triggered remotely (reading a "welcome to the congestion charge zone" message, for example); and blue tooth communication with on board devices installed by XCD.

XCD Comms, by Ken Liddell

An accurate, real-time determination of the trial vehicles' positions is crucial to the trial. Additionally, second-by-second journey data was required for post processing by other VAS trial partners.

As GPS is used to determine vehicle location, this provides UTC as an independent source of time-stamp data, used throughout the VAS communication chain.

XCD Communication Ltd (XCD) contributed an integrated suite of technologies focused around the core functionality of GPS-based positioning technology.

To facilitate the range of communications methods required, the on-board-unit (OBU) that XCD chose to use was the TrakM8 T4 GPS platform. This OBU offered the facility for every aspect of position logging and reporting to be configured.

The choice of the TrakM8 T4 proved to have many benefits. The trial managers can administer the vehicle and have access to real-time vehicle location and status information. They can display historical journey information as a 'snail trail'. The T4 offered high accuracy location data with fast signal acquisition. Reporting was enabled over UDP with a three second period. Where the UDP network coverage failed, position data was logged in the OBU for later transmission.

Two methods were used to identify the vehicle driver. One was to include RFID detection, where the driver is 'tagged'. And the second was to include Blue Tooth (BT) connectivity to the GPS unit. When a paired BT mobile phone was in the vehicle, its BT ID is recorded by the OBU and transmitted to the server.

The final configuration ensures that end-to-end system efficiency, vehicle detection in the zone, selection of the appropriate VAS message, time of message arrival, are all determined with respect to vehicle position in near real time.

SEA, by Mike Burbeck

SEA's Mike Burbeck's team managed the overall requirement and test documentation, programme, risks, issues and lessons learnt for each version of VAS up to its current version of VAS4.2.

Jeremy Evans, right, demonstrates value added services to Dr Stephen Ladyman at the ITSWG

Once integration was completed, Mike undertook user acceptance testing. Initial testing was followed by on-street testing in Southwark, London. Mike travelled in a VAS trials vehicle testing the phone and interactive voice functionality, with Rob Oldaker in the office ensuring that the website was configured for each test. Problems were either remedied in sufficient time for the test to be continued or a resolution agreed with the relevant company.

Upon satisfactory completion of User Trials, each version of VAS was delivered to TfL with an agreed list of functional capabilities and limitations.

Throughout the task, Mike has also been key for question clarification, problem resolution and information exchange. Regular meetings have been held in London, but the international dimension to this project has required extensive and successful use of e-mails, Internet access and SEA-based conference telephone calls to ensure good communication and understanding.