Annex I
System Architecture

Introduction

I.1 This Annex discusses the sort of system architecture that would be needed to implement road pricing. System architecture refers to the organisations that would be needed; the roles that they would need to perform; how they would need to interact; how members of the public would interact with them; and how this system would be regulated.

I.2 This work is preliminary. More work will need to be done before any road charging system could actually be procured: a detailed commercial assessment of the costs attached to different structures and configurations; a full risk assessment looking, in particular, at potential integration risks and the optimal allocation of risk between different parties; an analysis of transitional issues to identify potential roll out problems and determine how these could be managed; and a market sounding programme.

I.3 The Government has already developed a 'Road User Charging Organisational, Functional, Process and Data Model,' known as the 'UK business model', as part of its previous work on road user charging.[1] Deloitte Consulting has evaluated the system architecture envisaged in this model and identified variations which might improve its efficiency.

I.4 They concluded that, with modifications, the system architecture envisaged by the UK business model would provide an effective, efficient and robust structure for organising road user charging, and that it would protect road users' privacy. This would apply whether the system was used to deliver a national road charging scheme or simply a series of interoperable local schemes.

I.5 This Annex sets out the system architecture envisaged in the UK business model, with the modifications proposed by Deloitte, and then explains how it would work in practice. More detail is available in Deloitte's report, which is available on the Department's website.

Overview of the UK business model

I.6 This section provides an overview of the system architecture envisaged in the UK business model, as amended following Deloitte's recommendations[2].

I.7 The model describes, at a high level, the key organisations that would be needed to run an electronic road charging scheme or schemes, and the main interfaces that would be needed

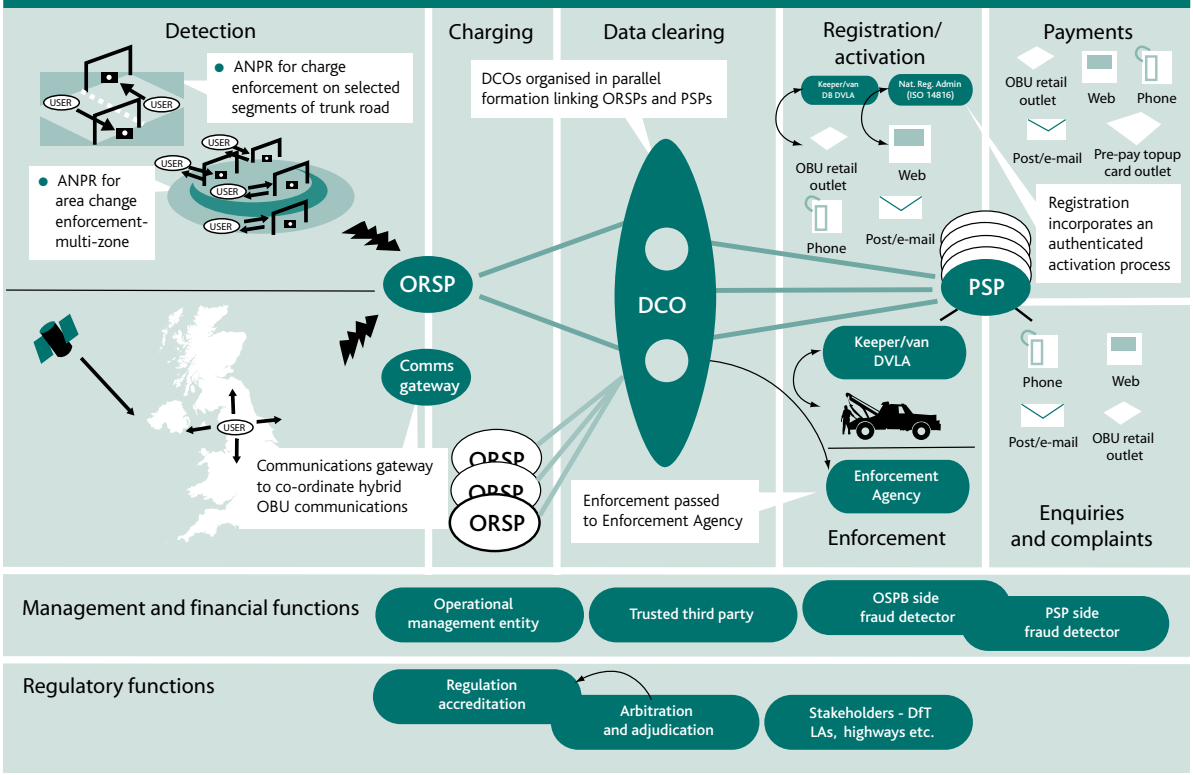
1 Department for Transport 2003, 'Road User Charging Organisational, Functional, Process And Data Model For Interoperability'.
2 DfT will consider these recommendations further in the context of its wider road charging research programme. This position should not be considered definitive at this stage.

to ensure interoperability with other UK electronic road charging initiatives (such as the Lorry Road User Charge). It was designed to:

- encourage a viable competitive market for the provision and operation of road user charging systems and services, with the long term objective of providing these cost effectively
- ensure that road users' privacy is protected, where they operate in accordance with legal requirements for the use of charged roads, as far as is compatible with the protection of the system against fraud.

I.8 The model is set out in Figure I1, and the key entities are explained in more detail below.

Figure I1: System architecture envisaged by UK Business Model



I.9 The **Communications Gateway Entity** would be responsible for handling communications with On-Board Units (OBUs) installed in vehicles, and forwarding records sent by OBUs to the appropriate On Road Services Provider.

I.10 **On Road Services Providers (ORSP)** would be responsible for installing and operating any roadside infrastructure and systems needed to detect and identify a vehicle travelling in the charging area or on charged roads, as appropriate.

I.11 **Payment Services Providers (PSP)**, on the other hand, would be responsible for registering customers, issuing bills to them, and collecting payment from them. They would also be responsible for guaranteeing the payment.

I.12 The **Data Clearing Operator (DCO)** would be an independent body. It would sit between the On Road Services Providers and the Payment Services Providers, collecting vehicle

identification and charge liability data from the On Road Services Providers and forwarding it to the correct Payment Services Provider for billing.

I.13 The **Enforcement Agency** would be responsible for identifying individuals who evaded the charge and issuing penalty charge notices to them. It would most likely be a specialised, public sector, body.

I.14 In order to maintain competition and promote cost effectiveness, the model allows for multiple On Road Services Providers and Payment Services Providers. The Data Clearing Operator would co-ordinate information flows between On Road Services Providers and Payment Services Providers, ensuring that road charge data is sent to the correct Payment Services Provider, preserving system effectiveness.

I.15 In order to protect road users' privacy, the Data Clearing Operator could remove location-specific details from the On Road Services Provider data so that the Payment Services Providers, who would hold customers' name and address details, do not receive data on where a vehicle has been. No one entity would consequently be able to link records of vehicle movements and details of individual road users.

I.16 These privacy safeguards are not absolute. If, for instance, a user requested an itemised statement, charge point ID information would have to be sent to the Payment Services Provider, giving the Payment Services Provider a full picture of where a user had travelled, the type of vehicle driven, their address and contact details.

The UK business model in practice

I.17 This section sets out how the system architecture envisaged in the UK business model would work in practice, were a national road charging scheme to be implemented. It should be noted, however, that the architecture could equally be used, with modifications, to support a series of interoperable but independent local schemes, electronic charging schemes using microwave or hybrid technology, or schemes in which OBUs were not mandatory and large numbers of unequipped occasional users existed.

I.18 The first step would be for individuals to select a Payment Services Provider. They would have considerable choice in this. The Payment Services Provider might be a utility with which they already had an existing account, such as an electricity or water account. Alternatively, it might offer a range of value added services that attracted them. They would not, however, have to worry about the quality of travel and charging information they would receive, because a central body would co-ordinate the provision of information and set minimum service standards.

I.19 Once they had selected a Payment Services Provider, the individual would need to set up a road charging account with them. They would provide vehicle (e.g. registration document) and identity (e.g. utility bill) details to the Payment Services Provider, supply evidence of any discounts or exemptions that they qualified for, and select a method of payment. This could take one of a number of forms – for instance, they could choose to pay by direct debit, credit card, cheque or cash. They could also decide, depending on the capability of the scheme, whether the account would be pre- or post-paid. The Payment Services Provider would verify these details were accurate and, if the customer wanted to be billed in arrears, verify their account details with their bank and request a credit check. Once all of these checks had

been completed satisfactorily, the account would be set up. It would then need to be linked to an OBU.

I.20 If complex hybrid OBUs were used to implement road charging, they would probably have to be fitted as standard in new vehicles, as retrofitting would be too complex a task. All that would have to be done would be for the Payment Services Provider to link the OBU's unique number to the user's account and vehicle registration number. Installing OBUs during manufacture would probably require a European Vehicles Directive, which in itself would take time.

I.21 If OBUs could be retrofitted, the individual would need to obtain an OBU from the Payment Services Provider, or another designated organisation, and get an approved garage to fit it. Once this process was completed, the individual would simply register their OBU number with the Payment Services Provider.

I.22 The Payment Services Provider would then send the OBU number, and a mapping to the vehicle registration number, to the Data Clearing Operator. This would also allow the Data Clearing Operator to send OBU charge data to the right Payment Services Provider, and to deal with any instances where the OBU charging process failed and an image of the vehicle licence plate was captured instead.

I.23 Once the individual got on the road, their OBU would automatically record which charge zone(s) or charged roads the vehicle used, the distance travelled, and the time of day. It would transmit this record to a central Communications Gateway which would pass records on to the relevant On Road Services Providers. Each On Road Services Provider would calculate how much it was owed and forward the data records to the Data Clearing Operators – it would only have an OBU number, and would not be able to connect this number to any individual user.

I.24 The Data Clearing Operators would remove any locational data to ensure that the user's privacy was protected, and forward the record on to the relevant Payment Services Provider (unless an itemised bill had been requested). Once the Payment Services Provider received details of the charges for a particular OBU from each On Road Services Provider – which would now contain no details of where the user had travelled – it would determine which individual user's account the OBU number corresponded to and issue a bill.

I.25 Inevitably, some users would seek to evade paying the road user charge, perhaps by avoiding having an OBU fitted, or by tampering with the OBU. In order to deal with this possibility, each On Road Services Provider would have a network for enforcement, such as ANPR cameras, some of which would be static and some mobile.

I.26 As the road user passed by, the enforcement infrastructure would capture an image that would be processed to produce a record of the vehicle registration number. The On Road Services Provider would compare this record with its records of OBU transmissions to check that the vehicle did not have an operational OBU and, if it did not, forward the record to the Data Clearing Operator.

I.27 The Data Clearing Operator, after performing the necessary checks with Payment Services Provider to ensure that the record was accurate and did not reflect an OBU malfunction, would, in turn, forward the details of the case on to the Enforcement Agency. The Enforcement Agency would contact DVLA to obtain the registered keeper's name and address, and issue a penalty charge notice as appropriate.

Conclusion

I.28 This Annex sets out only one way that the system architecture envisaged in the UK business model could be used to deliver road user charging. It is, however, a flexible model designed to promote competition and safeguard users' privacy in a variety of contexts.

I.29 The model has been designed to allow equally for a series of interoperable local schemes, in which each local authority might run its own On Road Services; simpler schemes using microwave technology, in which On Road Services Providers would record road use using electronic beacons deployed by the side of roads rather than complex hybrid OBUs; outputs from satellite location-based charging schemes; schemes in which OBUs were not mandatory and large numbers of unequipped occasional users existed (in which case these road users would need to purchase a simple daily licence in much the same way as someone driving into central London today); or a combination of one or all of the above[3].

I.30 We believe the model is an effective, efficient and robust structure for organising road user charging, and that it offers substantial protection for individual road users' privacy.

3 These scenarios are considered in Deloitte's report, which is available on the Department for Transport website.