

# DEVELOPING INTEGRATED SMARTCARD TICKETING

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## 1. INTRODUCTION

### 1.1 Integrated Ticketing – Why?

We live in uncertain times with the global impact of financial pressures, volatile energy prices and diminishing supplies of road and other fuels increasingly influencing our dependence on sustainable, public transport.

Sustainable transport is often equated with public transport, as an efficient mover of many people rather than the car, typically carrying fewer. Modal shift, from the car to public transport, is influenced by a number of factors including the price of car fuel versus fares for bus, rail and subway and the level of convenience for the passenger. For commuters, where their home and work are not located within reasonable walking distance of a single mode or service, a change of bus or train introduces an additional complexity and deterrent. Indeed it is often stated that it is the trips at the start and finish of each journey that are at the 'tipping point' for the car user's shift to public transport. If these trips are too time consuming, car owners consider they can avoid this extended journey time and enjoy a single uninterrupted trip, although no doubt increasingly with some extra stress from driving on congested roads. Those tentatively considering a switch to public transport, also have to carefully examine suitable routes, journey times, operators, timetables, fares and ticketing opportunities.

A challenge, in promoting and generating greater use of public transport, is to reduce if not eliminate these barriers to make the passenger journey appear as seamless as possible. For habitual car users, the task to persuade them to utilise public transport is arguably greatest.

Integrated *Ticketing* undoubtedly has a role to reduce the number of ticket transactions necessary to undertake such trips and the most successful arrangements will do so at competitive fares. The role of Integrated *Transport* is to provide the vehicles and routes to facilitate travel and once a network of routes exist, Integrated *Ticketing* can greatly assist in making the traveller's journey appear relatively *seamless*.

## 2. BACKGROUND TO INTEGRATED TICKETING IN THE UK

The UK has a deregulated public transport sector with a free market in bus services that has evolved through a cycle of an initial plethora of businesses entering the market in the 1980s to a more mature and stable offering since the late 1990s. Today much of the UK market is dominated by a number of large transport groups who, in the last decade, have also acquired rail franchises and extended their activities overseas as opportunities have arisen for investment.

Whilst such market freedom has created competition or the ever present potential for it, it has also segmented the market through commercially driven pressures on operators to retain passenger loyalty on competing corridors. Whilst economists may argue this is a sound economic benefit, others argue that it is detrimental to the delivery of integrated ticketing solutions.

For example, the commercial objective is retention of patronage on same-operator services through single-operator season or day ticket products. This is a perfectly understandable pressure and feature of de-regulated transport, driven more by the local need for operation of profitable routes than global market share.

However, these influences are potentially a disincentive for such operators to participate in multi-modal or multi-operator ticketing arrangements that provide opportunities for passengers to switch to competing operators *en route*. Alternatively, some argue that the convenience of the integrated ticket may promote more journeys for all, if the price is right and grow patronage with a positive revenue yield.

Integrated multi-modal, multi-operator ticketing solutions exist in a number of areas across the UK and in Scotland, in some significant arrangements, including ZoneCard in the SPT area and One-Ticket in the East.

The demand for such tickets is clearly influenced by the diversity and number of modes, operators, overlapping and contiguous services. The range and mix of these varies throughout the country with uniquely, in London, TfL being a single operator of several modes including franchised bus, underground and rail services. In contrast, in the SPT area bus and rail operate in a free market of around one hundred different operators with only the Subway and a ferry service operating wholly in the public sector.

The operation of integrated ticketing solutions in each is fundamentally different.

TfL, as the provider of three modes, is able to set the business rules, such as the fares, criteria for distribution of revenue and the inter-operability of ticketing and determine the suppliers independent of any other parties. Only, when considering integration of TfL's ticketing with external transport providers, are new considerations and complexities introduced.

Outside London, where public transport is provided predominantly by the private sector, such complexities are amongst the first challenges to be addressed in introducing integrated ticketing. Many countries have public transport networks operating within the public sector, where such complexities do not exist. Often it is urban areas that have successfully introduced smartcard solutions.

In the UK, in the mid 1990s, government and the private sector recognised these constraints hindering the development of integrated ticketing in the UK and stifling the will to invest in modern technology. The successes of TfL's *Oyster* smartcard and of *Octopus* in Hong Kong are examples of rapid acceptance of the technology by the travelling public in metropolitan areas. However, smartcards that are truly inter-operable in multi-mode, multi-operator environments are rare. Commercial operators, whilst willing to participate in existing non-smart ticketing arrangements, are unlikely to embrace the new technologies until they are developed, proven and trustworthy. Crucially, they must be also be operable either at a cost which is not excessive when compared to current ticketing and cash handling costs or generate sufficient patronage growth to offset such additional costs, or ideally, a combination of these two.

In recognition of this and no doubt other factors, ITSO (formerly, but no longer an acronym for 'Integrated Transport *Smartcard* Organisation') was founded in 1998. This body has strived to produce a standard and specification that addresses these concerns and creates a working, proven solution through involvement of all stakeholders. More recently this specification has been adopted by various accredited suppliers in the delivery of 'ITSO' compliant systems. In addition, government has declared the ITSO specification as the desired and credible solution. This should underwrite the introduction of inter-operable smartcards into the wider UK market and more so recently by incorporating it into the conditions for bidders undertaking new rail franchises. Increasingly, Europe is partly following the UK example and privatising public transport with franchising and thereby also beginning to encounter these new challenges of distributing revenue outside a public entity. The creation of a new standard for inter-operable smart cards across Europe, such as *Calypso*, is therefore becoming desirable and adding a further complexity of cross-border transaction processing.

The bus is public transport's prime people mover in the UK and the national concessionary free travel scheme, for the elderly and disabled in Scotland, was introduced for this mode in April 2006. Simultaneous with this the former concessionary paper passes were converted to smartcards, utilising the National Entitlement Card (NEC). Bus operators are presently being provided with the electronic ticket machines and smartcard readers to facilitate this enhancement. Once complete, Scotland will possibly be the first nation to have all its local service buses fully equipped with Smartcard readers.

The primary users of this technology will be concessionary travellers, as few significant commercial smartcard ticketing arrangements operate for the non-concessionary traveller. With the on-bus infrastructure soon to be in place throughout Scotland, the opportunity for developing commercial ticketing on smartcards is imminent. The highest volume of transaction processing for smartcards in the UK, in 2009, is probably being generated by the Scottish Concessionary Travel Scheme and increasingly through the *actual use of smart cards* on electronic smart ticket machines. This provides a complete test of the system through card issuance, transactions, ETM updates to central processing HOPs and revenue distribution to operators.

However, the processing of transactions for commercial ticketing arrangements, for the reasons mentioned previously, is more complex than those for concessionary travel transactions. Existing multi-modal multi-operator ticketing arrangements do not necessarily translate easily into smartcard solutions. Such arrangements normally function as Stored Travel Rights (STRs) with potentially complex zonal boundaries and conditions of use. The methodology of distribution of revenue amongst participating operators will often have evolved over many years with accepted principles, business rules and conciliation processes underwriting the administration and sustainability of the ticketing arrangement. Smartcard technology can offer new and better solutions for both operator and traveller, but introducing such change after a long period of stability, will require a process of considerable consultation with all stakeholders.

This process, although complex, has the potential to provide smartcards for those presently denied, being those under 60 or not disabled or Young Persons. In fact this is the larger part of the population utilising public transport and will include those currently purchasing integrated tickets, primarily required for multi-modal or multi-operator journeys.

In summary, there are clearly challenges to introducing integrated smartcard ticketing. However, with buses in Scotland soon to be equipped with smartcard readers, an ITSO standard ready to be tested and two existing significant integrated ticketing arrangements, the opportunity has arrived for developing a solution.

### 3. THE FUTURE

Developing an Integrated Ticketing Smartcard will require considerable planning and initially, establishing the overall objectives for all stakeholders.

#### 3.1 Objectives

Transport Scotland circulated its Integrated Ticketing Strategy Consultation questions in 2008 seeking views, inter alia, on whether there is an emerging consensus that Integrated Ticketing is an integral part of the development of our public transport system.

In earlier years, prior to publishing in 2008 its Regional Transport Strategy for the West of Scotland and Integrated Ticketing Action Plan, SPT had consulted widely on integrated ticketing.

Integrated ticketing exists in the SPT area in 'ZoneCard', which provides a photo ID card and a separate magnetic stripe ticket permitting travel on bus, rail, Subway and ferry, across 75 zones. Conversion of this ticket, to a smartcard is theoretically possible and this will be explored later. However demand for such integrated tickets is estimated to account for around only five percent of all public transport journeys. The greatest potential for growing patronage on integrated ticket smartcards therefore lies elsewhere.

Consideration of the objectives of *integrated smartcard ticketing* for passengers, operators and stakeholders will help to define the product and the market:

#### 3.2 Likely passenger expectations:

- Accessible and easy to use, on reliable and fast smart readers.
- Seamless travel across all modes, operators & interchanges.
- Recognition of local market needs.
- No coin or transactions for, say, 90% of journeys, but on a secure card.
- Options for both 'anonymous' and registered cards (for high value).
- Flexibility for purchase and top-up.
- *Oyster* style of operation, including assurance of 'capped' fares.
- Casual users may prefer an *e money purse* for *pay as you travel*.
- Regular users may wish *stored travel rights*, to maximise fare discounts.
- Same level of convenience as enjoyed by existing concessionary travel cardholders.

- Migration on to new emerging technologies, such as mobile phone ('NFC').
- Inclusion of a retail application on the smartcard for low value purchases, such as newspapers and snacks.
- A branded smartcard, readily recognisable, possibly with the potential to load other applications on it, such as parking.
- Security of personal data (registered cards only), but a tolerance of name and journey information being available to operators, where such agreement permits beneficial offers on fares and marketing promotions.
- Visual and audible 'beep' fare validation prompt, on entry, for passengers.

### **3.3 Likely operator expectations:**

- Sustainable administration costs.
- Generation of patronage, despite reduced passenger loyalty.
- Reduction in cash fare transactions, cash floats and cash handling.
- Smart card Ticketing Arrangement managed by an independent and trustworthy body.
- Strong card security and reliability.
- Reduced volume of payment transactions and cash handling costs.
- Increased security for bus drivers/staff from reduced volume of cash handling and storage.
- Reduced pressure on drivers and ticketing staff from fewer transactions.
- Positive benefit on passenger boarding times.
- Equitable business rules for revenue distribution.
- Compliance with Competition Act requirements.
- Reduction of revenue leakage from current levels of fare evasion (and on overriding on bus, if exit readers are available).
- Reduction of ticket inspection activity as a result of the above.

- Increased knowledge of travel habits of anonymous passengers (or known if card is registered, provides the capability of the linking of first and subsequent trips – presently an unknown, but will be very useful for route planning and targeted offers for loyalty and other marketing opportunities).
- Passenger ‘churn’ (turnover) identifiable, but for registered card holders only. (Experience indicates passengers gradually accumulate several cards for *convenience*).
- The introduction of exit readers on buses offers enhanced profitability from superior analysis of passenger journeys through to destination, thereby facilitating ‘fairer fares’ from more equitable charging for actual distance travelled.
- With environmental awareness growing and our personal carbon footprint from flights or rail journeys now printed on our pre-planned travel arrangements, the possibility for bus has arrived too where exit readers facilitate calculation of precise journey length.

#### **3.4 Likely benefits for all Stakeholders:**

- Improved management of public transport due to the higher quantity and better quality of data available, which imparts greater knowledge of onward journey patterns and enables services to be more efficient and tailored to better match passenger needs.
- Growth in day tickets, abstracted from singles and returns in the last decade, has significantly reduced the data available to bus operators as destination information has been lost – smartcards used on buses equipped with exit readers could restore availability of this valuable data.
- Accuracy of data is a key benefit already realised in smartcard concessionary ticketing, where systems can identify misuse of cards.
- Concessionary and disabled travellers often travel with fare-paying family members, such as grandchildren. An *e transit purse* option would enable them to pay the fares due using such a separate application on their concession card, alongside validation of their own free-journey. Further, where parents of such grandchildren are prepared to top-up transit purses on behalf of concessionary cardholders, the mobility of the family is greatly enhanced by such seamless ticketing on one card.
- Greater use of smartcards *by all* de-stigmatises their, as presently restricted to the elderly and disabled.
- Elimination of most paper/card tickets vastly reduces waste and litter.

- Lost pre-registered cards should be readily replaced, with *stop listing* systems eliminating abuse.
- Opportunity to mix a smart transit card with other applications on the card to provide pre-paid entry to concerts, sporting and other events and thereby promote the use of public transport.
- Budgets for Local Authority funded local-bus service tickets for scholars can be reduced by funding *actual journeys only*, thereby excluding payments for absences, with the resources released re-invested in funding other transport needs of scholars.
- Youth or unemployed incentive schemes, providing free or subsidised travel, can be directly funded for specific journeys on smartcards, rather than in cash or tokens, which may otherwise be spent/exchanged for invalid purposes. Social and economic benefits can be realised from such changes.
- Use of recyclable smart tokens can provide a cheap re-usable facility for single trips without the need for a plastic smartcard.
- Installation of exit readers on bus can potentially close the only remaining gap in verification of concessionary reimbursement and eliminate present criticism, whether valid or not, of driver/operator abuse from overstating concessionary ticket passenger destinations. In future smartcards alone will generate a single and valid journey record for each genuine passenger: a very important new control. However, without exit readers the other variable of *journey length*, essential to the calculation of reimbursement, remains unproven. Thereafter, a further challenge is how to encourage *non-fare* paying concessionary travellers to 'tap-out' on exit and there is a possibility of using vicinity cards to automate the process. The normal *proximity* smartcards work within a few centimetres of a smart reader, but vicinity cards are detectable around a metre away (i.e. *within range* on exiting through the bus door). Smartcards therefore could significantly tighten controls over concessionary reimbursement claims and reduce any public concerns.



#### 4. SCOPE AND COVERAGE

There are 2.1m citizens in the SPT area, but which market segments of passengers might use a new commercial ticketing smartcard and for what type of journey? – see Table 1.

What benefits over existing ticketing, such as Magnetic Stripe tickets, will smartcards bring and what are the present methods of passenger ticket issuing, checking and back office processing? – see Table 2.

Table 1: Possible users of smartcards by type and mode of travel:

Passenger by journey type	Bus (a)	Rail (b)	Subway	Ferry
Concessionary	(a)	√	√	√
Commuter	√	√	√	√
Shopper, tourist, etc	√	√	√	√

Table 2: Passenger ticketing events presently and with smart cards, by mode:

Event	Mode of transport			
	Bus	Rail	Subway	Ferry
Entry/boarding vehicle	Show (a)	Show/ MS (b)	MS	Show
Ticket inspection on vehicle	Show	Show	Show	Show
Exit vehicle/gate	None (c)	Show/ MS (b)	N/A (d)	Show
Ticket renewal (e)	Replace	Replace	Replace	Replace
ZoneCard (f)	Show	Show/ MS (f)	MS	Show

- (a) Bus - All pre-purchased tickets are 'show' only to driver (or purchase from) on boarding, *except* for concessionary travellers on buses equipped with smart readers, who show (photo-ID on smartcard) *and* 'tap-on', and of course already travel free.  
All ticketing could become *smart*.

- (b) Rail - Gates reading *Magnetic Stripe* tickets are installed at Queen Street & Ayr stations for both entry and exit (2 of approximately 150 stations in the SPT area). Rail tickets of course have a visible print of route, fare, class, date, etc that is used for inspection at non-gated stations and on-train inspections.

All ticketing could become smart, by installing *smart* gates and barriers at more mainline stations and introducing smart handheld readers for on-train inspection. Such moves could control and validate a substantial part and number of all rail trips.

National rail travel is likely to continue with MS ticketing for some years however.

- (c) Bus - Exit Readers are not installed on any buses and there is therefore no validation capability yet for smartcards for journey length, for concessionary travellers, or commercial smart ticketing in future. Ticket inspection and driver intervention are presently the only controls or deterrent for passenger over-riding.
- (d) The Glasgow Subway - MS readers operate on all *entry* gates and a flat fare system avoids the need for a closed system; no ticket verification on exit, where all turnstile gates are *unrestricted*. Tickets are only MS and similar to rail, including printed visible information.
- (e) All existing tickets in paper or MS card form, have to be replaced on renewal with no electronic updating or overprinting. Concessionary smartcards however can have validity of free travel extended electronically, as can commercial journey smartcards, thereby eliminating paper & card waste tickets and MS handling mechanisms in gates (smartcard readers are wholly electronic and maintenance-free).
- (f) Zonocard integrated tickets – Function as a photo-ID *and* a separate MS ticket (as Subway & rail). MS part is validated at rail and Subway stations equipped with MS readers. However, there is no collection of journey data: currently all operators have *passenger diary* or *on-vehicle passenger surveys* conducted for calculation of both passenger volume and journey length for distribution of ticket sales revenue.

## 5. THE TECHNOLOGY

Many years ago the ability to record data and increment or decrement value electronically was introduced with the addition of the magnetic stripe on card tickets, which transformed the traveller's journey by automating validation of tickets at machines, gates and barriers.

The development of smart cards, commonly understood today as incorporating a micro processor chip, followed. Now in a contactless form, unlike the bank or credit *chip & pin* cards, the use of an aerial, RFID (radio frequency identification) circuit and memory enables the card to operate swiftly as a *touch and go* in close proximity to a reader, with a transaction time typically faster than 500 milliseconds. Fast operating speeds are crucial for the transport environment.

The provision of memory on the card, together with security software 'keys', provide the opportunity for a number of applications to be loaded and that might include a basic season ticket, transit purse and retail application.

The smart card has no battery and has no metallic contact, being powered by induction from the smart reader and it exchanges data in both directions by radio waves. Whilst plastic cards are the common form of hosting this 'media', the microchip can be located in any other suitable holders, such as watches, mobile phones or even in plasticized stickers. Evolution of the smart card into other media is therefore only restrained by the size of the chip and the RFID aerial.

In banking, the introduction of cheque guarantee cards, magnetic stripe bank cards and the progression to cards with *chip and pin* were readily accepted by the public. These technologies eliminated manual checking of paper cheques, through the use of magnetic inks and latterly to a massive reduction in the use of cheques as card usage grew. A decade later transport, globally, is following a similar revolution in ticketing, although with the UK (outside London) some years behind.

However, progress to a smartcard from paper ticketing brings a small penalty through the loss of the traditional printed visual information. This has been necessary for manual ticket inspection and providing passengers with a means of confirming validity too. These are overcome by providing handheld smart readers for ticket inspectors and ticket machines for passengers, if not on-line access.

It is important to note that the ticketing system, remote from the smartcard, requires a comprehensive back-office infrastructure to record all transactions and mirror the 'experiences' of the card. The card is simply the medium through which all of the derived functionality is achieved. As in the comparison with bank cards, a substantial computer network for processing data transfers, transaction processing, encryption, analysis and revenue distribution is the 'engine' of the system and the smartcard is simply the *access key*. Conversely, non-travel transaction functionality such as top-ups or status enquiries do not need the card present and can be conducted conveniently on-line. Robust, reliable and secure systems are necessary to support the offline journey transaction batch-processing, such as on bus, or live processing as encountered on fixed ticketing terminals in Metro and Rail operations.

## **6. BUSINESS CASE**

The justification for integrated ticketing and smartcards is primarily that of passenger convenience. Given the rapid acceptance of Oyster and Octopus smartcards, often by travellers using only a single mode of transport for return trips, the convenience factor clearly extends into markets outside *integrated* transport. Proving a commercial case, including that of patronage growth, is more difficult as often extraneous generation factors cannot be isolated. A careful examination of evidence from significant established smartcard implementations would be necessary and there are few in the UK. However, there are a number of areas where opportunities arise and some of these have been included, above, as likely operator objectives or stakeholder benefits.

The delivery of a sound business case for individual transport operators to justify significant investment in the essential infrastructure is challenging, particularly where no tangible commercial return is generated from the social benefits such as the passenger convenience factor. The incentive to kick start smartcard ticketing arrangements is perhaps most likely to stem from a consortium of all stakeholders participating in a public sector, capital funded project. Once a working system is established, with growing acceptance of smartcards reaching the critical mass volume, a sustainable arrangement should be achieved. This eliminates the need for any medium-term commitment to revenue funding from the public sector. The capital funding would be expended in the new technologies outlined later.

So, when, where and how might *Integrated Smartcard Ticketing* be developed and why might SPT assume this role?

## 7. SPT CAPABILITY

### 7.1 The Subway

In many respects **Metro** systems represent the easiest implementation opportunity as ticket control mechanisms are installed at fixed gates on entry and exit to normally 'closed' stations. This compares favourably with the complexity of bus and ferry, where controls and ticket machines are on board moving vehicles. In rail, unlike Metro, only major mainline urban stations are *closed*, with recently installed gates and barriers, whilst most suburban and rural stations are open.

The Glasgow Subway is operated by SPT who have recently explored the potential for upgrading gates, barriers and ticketing systems and infrastructure.

SPT could replace the existing magnetic stripe ticketing system with a smartcard, in a phased introduction. The prime location of a number of Subway stations provides strong links to bus and rail networks and opportunities for future integration of ticketing with these modes.

### 7.2 The ZoneCard

This ticketing arrangement is administered by SPT on behalf of the Forum of operators, who could propose to migrate current MS ticketing to smartcard, once the appropriate infrastructure is in place, by:

- Converting the current Photo ID into a photo carrying smartcard:
  - For use on bus, ferry and Subway as a ticket;
  - For use on rail as the photo ID part only.
- Continuing the magnetic stripe rail station-issued tickets:
  - For use on Subway, until MS gates are fully replaced by smart readers;
  - For use on rail, until smart-enabled gates, etc are available.
- Establishing new Business Rules covering;
  - Offering of a:
    - zonal (STR), mirroring existing zones; or
    - a transit purse operation, or
    - both;

- Method of acceptance of smartcards on each mode (see previous table 2);
- Method of revenue distribution options;
  - Continue with Diary and passenger surveys:
    - (i) But only for journey length calculation;
    - (ii) Utilise smartcard-generated journey data, instead of surveys, for volume data;
    - (iii) Promote installation of exit readers on buses as a means of automating item (i) above.
  - Blend of the above, but must comply with the Competition Act requirement for an operator mileage-based percentage of total mileage reimbursement methodology, unless the Block Exemption is repealed.
  - Possible alternative of introducing a more accurate *interim* payment method, reflecting actual volumes, but *estimated* journey lengths. Currently, periodic estimated payments between six monthly surveys have to be based on historic payments and are not flexed for volume changes. Volume data could be provided daily from smartcards.
- Utilising Regional Transport Partnerships to promote all-operator participation:
  - The Transport (Scotland) Act 2001, for bus, empowers:
    - the monitoring of Ticketing Arrangements and ;
    - consultation on implementation of new ones;
    - including formal Ticketing *Schemes* where agreement on an *Arrangement* has not been reached.
  - The conditions in award of contract, to transport operators providing supported bus services, often require participation in Integrated Ticketing arrangements.
  - The Scottish Government's paper, *Buses for Scotland, Progress through Partnership* is a guide for Local Authorities, RTPs and bus operators and was published in September 2008. In it, responsibility for the establishment and implementation of Integrated Ticketing Schemes within their areas will lie with the relevant Public Transport Authorities, such as SPT.

### 7.3 Implementation Plan

- Establish a Ticketing body to manage the implementation after acceptance of a Business Plan.
- Plan the stakeholder involvement through the phases from initial development, implementation and on to the realisation of a sustainable ticketing arrangement.
- Investigate how the smartcard can be introduced into the target markets, including by passenger-type segments and by mode and the priorities.
- Thoroughly investigate, review and test the *Technology*. It is clear that the implementation will both change existing practices for all stakeholders in some way and also place absolute reliance on robust systems utilising these new technologies. Some of these issues are listed below;
  - ITSO compliant systems now, or *ITSO ready* or *upgradeable to*?
  - Which smartcard?
    - The current NEC (MiFare 4k concession card), or
    - A larger capacity card (possibly required for STRs).
    - Security satisfactory?
    - Card provider may have to hold FSA credentials if *e purse* holds money?
    - Anonymous *and* registered cards (for high values).
    - Card Management System required, particularly with back office customer support for registered cardholders.
    - If compatible on NEC, provide *transit purse* for SPT's concessionary scheme for rail, Subway and ferry, for the convenience of concessionary travel cardholders where a payment for the balance of chargeable travel is due.
  - Ticketing machines:
    - Bus – new on bus ETMs – adequate to cope with STRs?
    - Subway – new smart-enabled readers on gates (entry *and* exit)?

- Ferry – ETMs have operated in the marine environment on Govan/Renfrew and Gourock/Kilcreggan/Helensburgh ferries for many years, but without smart readers.
  - Rail – new smart-enabled readers to supplement existing magnetic stripe equipped gates in Ayr and Glasgow Queen Street (and possibly Glasgow’s Central and Partick stations in future)?
  - Hand-held portable readers/ETMs for Ticket Inspectors on all modes.
  - Operating speeds of card readers must not extend boarding or alighting times
- Central Processing – HOPs
- Who hosts and where – ACT, Ecebs, Logica and ERG are probably the main providers currently in the UK.
  - Each operator must have a terminal to consolidate:
    - (i) bus/ferry journey transaction/other data from the mobile ETMs to/from the local depot;
    - (ii) rail/subway journey data from the fixed gates;
    - (iii) with connectivity to the HOPs.
- Ticket Vending Machines (TVMs)
- Smartcards, once bought, should last for many years and TVMs are the means of maintaining or issuing smartcards.
  - The travel application can be loaded on the smartcard as:
    - (i) A transit *e money purse*, pending top-up, or inclusive of a nominal value on purchase.
    - (ii) As *Stored Travel Rights* (a season ticket permitting travel within zones, times of day validity, etc.)



- TVMs:
  - (i) Can be located anywhere, at Subway, Rail and Ferry station or non-transport sites, such as shopping centres and convenient locations for travellers;
  - (ii) Can load e *money purse* and top-up, for retail applications.
  - (iii) Because smartcards may not be issued or topped-up on-bus or ferries, TVMs must be readily accessible to bus users.
- Smartcard top-ups
  - PC based on-line top-ups will be convenient for some;
    - (i) But these transactions only update central systems and *not* the smartcard and so;
    - (ii) The smartcard still needs to be physically updated at a terminal, such as;
      - (a) A 'post' (point of service terminal) at a previously nominated location;
      - (b) A secure device capable of updating the smartcard and connecting to the CMS/HOPs.

## 8. CONSIDERATIONS

From the matters raised, it is clear that the pace of change for developing *integrated smartcard ticketing* in each mode will be influenced by many factors and these include:

- The provision of a HOPS and other infrastructure to service already existing and partly proven smartcards, (through their daily use on bus although restricted to concessionary travel).
- A willingness of major operators to participate in pilots:
  - The potential to test smartcard arrangements by utilising closed groups of travellers, such as Subway or other transport operators' staff, could provide a good trial, prior to launch.
  - However, the most beneficial test is not of the concept but of the real proposed system, in a semi-live environment. For example, a test of a *closed* system, within the Subway, does not alone facilitate the testing of the inter-operability and the ITSO features in a truly *open* system across all modes, operators and areas.
- Rail
  - Joining-up journeys inevitably involves rail in integrated ticketing solutions, but this mode has possibly not benefited from public sector investment, such as in the on-vehicle ETMs necessary for bus concessionary travel. Investment in smartcard readers in existing gates and barriers and in installing new gates and barriers in other stations will be required. (A possible pilot smartcard scheme between Edinburgh and Glasgow may be considered).
  - Will only mainline, city/town stations have gates and will they be fitted with smartcard readers for entry/exit controls?
  - Will suburban stations continue to operate with no ticket inspection on boarding/alighting?
  - Will current magnetic stripe rail tickets continue indefinitely until new conditions, for the introduction of smart cards in new franchises, are invoked across the UK?

## **9. CONCLUSION**

This paper has been a long and exploratory journey through the history of integrated ticketing and the opportunities for introducing smartcards in the West of Scotland.

It appears that there is now a growing expectation, on the part of the travelling public, transport operators and government, that the convenience of smartcards in ticketing is worth striving for.