Transport Scotland Aggregator Project

Discovery options & recommendations report

1. Document control

1.1 Change control

Version	Date	Author(s)	Change
0.1	08/01/2019	Jonathan Richards Rich Buckley	First draft
0.2	06/02/2019	Jonathan Richards Rich Buckley	Revised issue for sign off following stakeholder and project team feedback. Section numbers have not been adjusted significantly to ease the comparison and work on comments.
0.3	25/02/2019	Jonathan Richards Rich Buckley	Minor amendment to schematic in section 6.9 and updated Ferry retail options in 14.2
1.0	06/03/2019		Incremented version to 1.0 as report signed-off

1.2 References

Reference	Document	Version
1	TS Aggregator discovery deliverable descriptions and acceptance criteria.	1.0
2	TS Aggregator discovery exit plan.	1.0
3	TS Aggregator discovery project assessment report	2.0

1.3 Acronyms

Acronym	Description
ABT	Account Based Ticketing – either using a payment card to travel with capping rules in place or other combination of both pre-pay or post-pay travel with capping rules.
API	Application program interface – Defined interface for communicating between different computer systems.
ATCO.CIF	Association of Transport Co-ordinating Officers Common Interface Format.
cEMV	Contactless (EMV) bank card.
COTS	Commercial off the shelf IT solution such as applications or websites.
CPT	Confederation of Passenger Transport.

Acronym	Description
DfT	Department of Transport
DRT	Demand Responsive Transport – Fujitsu are defining this to be the existing pre-booked bus services operated by many local authorities and RTPs. These typically involve a phone or web based advanced booking and are not best suited for immediate travel. Vehicles are not tied to fixed routes and schedules.
DRT-NG	Demand Responsive Transport Next Generation – Fujitsu are defining this to include the existing and emerging transport services that are based on disruptive technology such as smart phones, cloud computing and online payment. Services such as Uber taxis, Uber carpooling, ViaVan, Arriva Click, CityMapper Smartride, etc. provide on-demand bookings through smart phones. Fares are typically estimated in advance and payment collected through the smart phone. Rides can possibly be shared with other passengers but don't have to be.
EBSR	Electronic Bus Service Registration.
GBFS	General Bikeshare Feed Specification
GTFS	General Transit Feed Specification (https://developers.google.com/transit/gtfs/).
HCE	Host Card Emulation – using a mobile phone that is pretending to be a smart card.
IATA	International Air Transport Association.
ITSO	ITSO smart ticketing specification.
MaaS	Mobility as a Service – user centric combination of multiple transport services that are consumed on a usage or subscription basis and delivered digitally. This has been enabled by ubiquity of smart mobile phones containing sophisticated computer, display, sensors and payment mechanisms; cloud compute platforms; new modes of transport; and more open transport and mapping data.
NeTEx	Network Timetable Exchange – emerging European standard covering services, routes, timetables and fares. DfT sponsored UK profile of NeTEx and adoption bas basis for UK open data.
NLC	National Station Code – identification of each railway station in the UK.
NRS	National Reservations Service used in the rail industry.
OAG	Airline data processors.
PCI/DSS	Payment Card Industry Data Security Standard is an information security standard for organizations which handle credit cards.
RDG	Rail Delivery Group.
RTP	Regional Transport Partnerships. SPT is an RTP.
SFTP	SSH File Transfer Protocol - a network protocol for secure file transfer
SIRI	Service Interface for Real-time Information
SPT	Strathclyde Partnership for Transport runs the Glasgow subway, bus services and undertakes administrative functions for transit for 12-member local authorities in the Strathclyde area.

Acronym	Description
TfL	Transport for London
TfN	Transport for the North
TLS	Traveline Scotland.
TOC	Train Operating Company e.g. ScotRail.
TS	Transport Scotland.
TXC	TransXchange. XML schema for services, routes and timetables. https://www.gov.uk/government/collections/transxchange
WebTIS	Web Ticket Issuance System

2. Management Summary

This report builds upon the Transport Scotland Aggregator Project Discovery Assessment, for the provision integrated fares and ticketing for all modes of public transport in Scotland. The Discovery Assessment reviewed the transport operators in Scotland across all modes, covering data, systems, ticketing, payment options and processes. The assessment provided the baseline to develop the solution options and recommendations presented in this report. The completed solution is expected to be developed in three stages:

- Stage 1 – Fares information enhancement
- Stage 2 – Retail hand-off
- Stage 3 – Single end to end journey purchase

For each stage of the solution, a range of design options have been considered. These were assessed for technical feasibility, alignment to uses cases, overall benefits contribution, alignment to strategy, value for money and risk. Based on these assessments, a preferred solution design option for each stage has been recommended. To support the recommendations architecture schemas, processes, a customer proposition and a reporting dashboard have been defined. The recommendations for each stage, are summarised in the following sections.

2.1 Stage 1 – fares information enhancement

Three solution options were assessed to enrich fares data by:

1. Re-using concessionary fares information currently supplied by bus operators to Transport Scotland. This option was rejected by the Project Board (see section 5.3.1).
2. Static fares provision - request all fares types from all bus operators.
3. Real time pricing – extending existing facilities used in the rail and air modes, to ferry and bus operators (where possible, otherwise static fares provision).

Recommendation

Develop real-time pricing links (as used in the transport industry) from the Traveline Scotland journey planner for air and rail, to include other operators such as bus and ferry where possible. Where this may not be possible, such as for some smaller operators, request information for all fare types from the remaining bus operators, with some fare format and process improvements (whilst the NeTEx standard is developed in the industry). Traveline Scotland should prepare for use of NeTEx provided data and make use of it where available. One operator has advised that they intend to start preparing data to NeTEx standards.

Key Benefits

- More efficient TLS fares data management processes.
- Increased provision of online fares information.
- Support for best value fares and advanced purchases.
- Improved first and last leg multi-modal journey planning.

Refer to section 5 for detailed descriptions of the options considered and the rationale for the recommended option.

2.2 Stage 2 – retail hand off

Three solution options were assessed:

1. Ticket purchase hand-off to operator web sites.
2. Provide additional information on purchase options where hand offs are not possible.
3. Implementation of both the above.

Recommendation

Develop ticket purchase hand-offs to operator web sites, supported by additional information on purchase options where hand offs are not possible. This could be achieved as a ‘quick win’.

Key Benefits

- Increased provision of online ticketing and fares info.

- Increased journey planning information for cycle schemes, DRT and DRT-NG services.
- More pre-payment for ticketing.

Refer to section 6 for detailed descriptions of the options considered and the rationale for the recommended option.

2.3 Stage 3 – single end to end journey purchase

Traveline Scotland originated single purchase of tickets for end-to-end journey.

Recommendation

It is recommended that Stage 1 and Stage 2 be implemented, and successes measured to build a business case for Stage 3. Stage 3 is anticipated to be both complex and costly to implement so the benefits and relevance need to be understood. During the business case development, consideration should be given to Account Based Ticketing across Scotland. Industry trends, trials and emerging technology is promoting ABT as the future of ticketing.

As part of developing Stage 3 of the project, a 3rd party API is planned to allow purchase of tickets as part of another application or service. This would allow a DRT-NG provided service where public transport rail/bus/coach/ferry is booked with first and last leg provided directly by the 3rd party. In addition, one could imagine a cycle share app including public transport for significant portions of journeys.

Benefits

- 'One stop shop' for ticket purchasing across transport operators and modes.
- Increased smart integrated ticketing take up across all transport modes.
- Revenue switch to public transport for new and occasional customers.
- More efficient and automated operations.

Refer to section 7 for detailed descriptions of the options considered and the rationale for the recommended option.

2.4 Demand responsive transport in journey planner

Outside of the stages listed above, this study recommends that DRT and DRT-NG options are more comprehensively included by the Traveline Scotland journey planner where they operate in a region.

For public transport to retain or grow market share and retain relevance, it must embrace the concept of point-to-point transportation when compared to bus stop to bus stop or station to station. These point-to-point services can be provided using "ride booking from mobile app" services such as Uber and their taxi competitors and the ride sharing services such as ViaVan and Citymapper to name two. Many of these services are in their infancy and having to deal with current regulation. Business models are being tested services evolve, new disrupters will arrive, and current provides will withdraw.

Many streets are too congested to have all bus journeys undertaken by smaller (private hire / taxi) vehicles however the contrast is empty buses running to a fixed schedule. The future will embrace both new and traditional transportation models. Flexibly-routed, on-demand transport for point based pickup and drop-off interfacing with main transit corridors operated using mass transit vehicles.

Allowing passengers to be able to select the right combination of modes for their travel requirements starts to provide a personalised and joined up service.

2.5 PlusBus

The rail industry has a product called PlusBus (http://www.plusbus.info/) which adds a discounted travel card for bus travel around a town. This can be used for the journey to a station or to a final destination. It is an established product which is retailed online by existing channels. Presently PlusBus is not offered by the Traveline Scotland journey planner as an option to solve a bus-rail, rail-bus or bus-rail-bus travel combination. This study recommends that PlusBus is fully integrated into the Journey Planner such that qualifying journeys are offered this as a priced ticketing option. Trapeze have already indicated that this could be supported at low risk, both quickly and at relatively low cost.

2.6 Next Steps

Building upon the aggregator solution recommendations made in this report, the next steps are to:

1. Develop the Transport Scotland aggregator Technical Specification taking existing supplier APIs into account.
2. Define an indicative outline solution implementation plan to inform the delivery of the overall solution.
3. Use a combination of estimated and supplier provided costings to develop an outline cost model for options.

3. Introduction

Transport Scotland, working with transport industry representatives, awarded an 'Aggregator Project Discovery Phase' contract to Fujitsu Services Ltd on 31 August 2018. This consultancy commission was to undertake technical research and solution development work for Traveline Scotland. The project is to research options and make recommendations for the delivery of an integrated fares and ticketing service for all modes of public transport in Scotland.

The output of this consultancy will be four documents as described in 'TS Aggregator discovery deliverable descriptions and acceptance criteria'[1] document:

- Discovery assessment.
- Discovery options and recommendations.
- Technical specification.
- Outline project plan.

This document provides the second of these deliverables summarising the key solution options and recommendations.

The background, objectives, requirements and scope of the aggregator project, are described in the Transport Scotland Aggregator project discovery assessment report[3].

The sections of this report cover:

- Section 4 – Discovery options and recommendations approach.
- Section 5 – Stage 1 fares information enhancement: assessment of options and recommendations.
- Section 6 – Stage 2 retail hand off: assessment of options and recommendations.
- Section 7 –Stage 3 single end to end journey purchase: assessment of options and recommendations.
- Section 8 – Assumptions and constraints.
- Section 9 - Process flows outlining the data management processes.
- Section 10 - Reporting dashboard.
- Section 11 - Customer proposition.
- Section 12 – Conclusion and next steps.
- Section 13 – Annex 1 Account based ticketing.
- Section 14 – Annex 2 Supporting material.

4. Discovery options and recommendations approach

4.1 Options assessment approach

The discovery assessment gathered information from operators and suppliers relating to systems, processes, data formats, APIs, use cases and benefits. This information was used to establish, where possible, a range of options for the Aggregator solution design, for each of the three outlined stages. To summarise, the stages are:

1. Enhance Traveline Scotland fares data set. Undertake an operator investigation to establish ticketing media options and the supply of fares data to Traveline Scotland best practice.
2. Ticket purchase hand-off to operator web site from journey leg result. Operator takes payment and issues ticket. Operator use their own preferred ticket media.
3. Single purchase of end-to-end ticket covering multiple legs and modes. Traveline or 3rd party would take the payment, with the operators issuing tickets.

Each of the options have been assessed for:

- Technical feasibility.
- Alignment to the use cases (from assessment report).
- Outline system development effort for operators and suppliers.
- Contribution to benefits (from assessment report).
- Alignment to the Transport Scotland Smart and integrated ticketing and payments delivery strategy goals.
- Risk assessment based on identified challenges (from assessment report), together with mitigating actions to minimise risks to Transport Scotland's investment.

Finally, the overall options ratings were used to derive the recommended Aggregator solution option.

4.2 Recommendations approach

Based on the options assessment work, options for each of the three stages were developed. These options were then relatively scored based on use case alignment, anticipated development effort, benefits and strategic alignment. Based on these scores and with a view on the long-term aspirations of Traveline Scotland recommendations have been made. Fujitsu has also recommended some improved processes for aggregation of fare data, provided an illustrative reporting dashboard and provided a customer proposition.

Highlights from the recommendations report will be presented to the Aggregator Project Board, to facilitate discussion on future stages of the project.

4.3 Use cases

Use cases were developed during the discovery assessment, as summarised in the table below. The use cases are referenced in sections 5, 6 and 7 to assess the solution options and ensure that the requirements of different use case scenarios are covered. The use cases have also been referenced in the development of the customer proposition in section 11.

Customer use case	Use case description
Local city commuter	5 working days per week within 6 miles of city centre on typical office hours. Requires use of combination of modes to get into centre from home. Does not mind walking sections of the journey if the weather is good. Looking for best value and reliable clean service.
Inter-city commuter	Works one day a week from home and has frequent trips to other cities for meetings. Rest of time spent in main office. Rail is the sensible mode of transport. Flexibility and reliability are of primary concern. Seasoned traveller and uses all the mobile phone applications for ticketing and journey information.

Customer use case	Use case description
Business traveller to Scotland	Typically flies into Glasgow or Edinburgh airports from London and uses local trains and buses as required. Intercity train into Scotland is too expensive and takes too long from home. Visiting Scotland at least once a month for a schedule of meetings in the major cities.
City off peak day leisure/retail visit	Typically travels from city by train and then requires unlimited use of local transport, with best value fares.
Domestic tourist walking trip	UK based tourist looking for outdoor activities. Wants to visit new places mainly for walking and some sightseeing at destination. Would love to explore the islands. Trip would be typically 5 to 7 day in duration. Weather would not deter this visitor from doing things but might change direction of travel.
Foreign tourist	Foreign tourist destination hopping. Taken an internal flight to reach Scotland and wanting to spend a fortnight "Doing Scotland". Interested in castles, distilleries and museums. The itinerary is planned prior to the visit.
Hospital visit	Infrequent traveller who must travel to a hospital appointment at a specialist unit. Does not want to use car as hospital parking is a challenge. Travel would involve using a combination of bus, train and walking. This is a good example of Mobility as a Service (MaaS) first mile/last mile.
Traveller with no detailed knowledge of public transport	Cyclist who normally cycles to work with no detailed knowledge of public transport, but then has to take public transport for a formal appointment.
Low income commuter with disrupted journey	Low income commuter who has to change mode of transport due to disruption but has no knowledge of other modes of transport and doesn't have money for a taxi.
Student in further and higher education	Student in further and higher education needs to travel to higher education institute for term time residence and frequently returns home at weekends. They have student ID for concessions. Alternative scenario included for student move to city flat in 2nd year, with day student requirements with repeated use on an irregular daily pattern, to attend lectures along with evening and weekend use.
Rural traveller	A. Rural traveller with part time work and leisure travel requirements. B. Rural commuter using park and ride facility
Islands resident regular traveller	Islands resident who travels to the mainland for their job and stays in the City mid-week returning to the island at the weekend.

5. Stage 1 fares information enhancement: assessment of options and recommendations

An assessment of options and recommendations relating to the integrated fares and ticketing solution design for stage 1, is detailed in the following sections.

5.1 Stage 1 description

The options assessed will need to address the scope of stage 1 which is summarised below:

- Enhancement of Traveline Scotland fares data set.
- Operator investigation on ticketing media and fares.

5.2 Stage 1 options

Fujitsu were requested to review 3rd party API providers to establish whether there were existing solutions to the data aggregation challenge or whether any such providers may be contracted in the future to provide such solutions. It was clear from the assessment work that the bus operators were not providing fare data to other parties and this was confirmed by a review of the market offerings. Most of the reviewed options use existing aggregation sources (e.g. Traveline UK routes and schedules national dataset) or existing APIs to data providers (e.g. airlines thorough OAG, railway operators through RDG data sets).

The following 3rd party API providers were investigated as detailed in the table below. Trapeze as incumbent data factory and journey planning service provider has not been included in the analysis below.

3rd party API provider	Comments and observations
Masabi	Masabi (http://www.masabi.com) JustRide platform provides services for MaaS including mobile ticketing, retail and ABT. Masabi are used by National Express West Midlands.
Here	Here (https://www.here.com/) provide location-based services and multi-modal journey planners. “Here” are known to provide the technology behind some European journey planners and ticketing systems. They have a UK journey planner that understands UK rail services but does not include fare information. They do have a fare enquiry API. No UK bus routes are provided. Journey plan information is nicely displayed.
transportapi	transportapi (https://www.transportapi.com/) provide timetable, journey planning and live departures. Fares are only available for taxi presently with rail listed as being available soon.
Skyscanner	Skyscanner (https://www.skyscanner.net) provide services and APIs for the global airline business. Skyscanner would be a good integration point for Traveline Scotland rather than interfacing with LoganAir APIs directly. The Skyscanner APIs are well structured and documented and would automatically deal with changes of airlines in the region. It would also cover flights inbound to Scotland (e.g. BA, Easyjet).
Google	Google (https://www.google.com/transit) are more likely to consume a data aggregation service than to provide it. They currently take a feed of the UK national Traveline bus dataset of services and schedules that is processed into the GTFS format for them. In this way, a Scottish operator service change will currently propagate to Google Transit over a number of weeks. Traveline experience indicates that getting Google to correct data can be a drawn-out affair.
Bytetoken	Bytetoken are part of the Siemens mobility family. They are offering a mobile ticketing, mobile payments applications coupled with other services from Siemens such as multi modal journey planning etc. They have no existing links to UK fares on any mode. Similar in product services to Masabi.

None of the above 3rd parties currently maintain bus fare datasets. Excluding Google (as they will want to take pre-aggregated data) and Skyscanner (as they are airline focused), the remaining three providers all have the technology and skills to provide a fares aggregation service. It is believed that they would however more likely to be interested in consuming aggregated fares information through an API rather than acting as the data aggregator for a multi-operator de-regulated bus market.

Irrespective of the company providing the fares aggregation service, feedback from the Project Board, has expressed a need to maintain control (albeit through contract) of fares aggregation for several reasons:

- Maintain control and accuracy of the source data through local knowledge.
- Leverage existing relationships with operators and councils to rapidly investigate any identified data issues.
- To be a single source of truth, without conflicting with data from other aggregators.
- Maintain control of fares information APIs.
- Ensure legal compliance.

Based on the Discovery requirements and assessment work, several fares aggregator solution options have been established for Stage 1, as summarised in the table below. Details are provided in the subsequent sections. These options can be supported by the incumbent data factory provider or any future supplier.

Ref	Option name	Option description
1	Reuse concessionary fares	Enrich TLS bus fares information with concessionary single adult fare information which is currently provided by operators to Transport Scotland. Concerns over accuracy and permissions to share data would need to be addressed. Interim fares standards improvements (before NeTEx implemented) such as NAPTAN code matching.
2	Static fare provision	Request all fares direct from operators where this is currently not supplied. This fare data provision will include all fare types, not just adult single. Manual processing may be required by operator to provide this data and TLS Data Managers to enrich the TLS fare data store. Interim fares standards improvements recommended (before NeTEx implemented) such as NAPTAN code matching.
3	Real time pricing across all modes	Model for real-time pricing across all modes of transport. This would be easy to re-use real time pricing model for rail and air currently used in the industry. For other modes, would require operators (or their suppliers) to provide an API and for commercial / volume / rate discussions. Traveline Scotland can externalise APIs and make these available to 3rd parties to broker queries. This would cover all travel modes, aggregating the underlying real-time queries or references to static data.

5.3 Technical and business considerations

For each of the stage 1 options, technical and business considerations have been described below.

5.3.1 Reuse concessionary bus fares

This option was raised by both bus operators and suppliers and therefore included in this report for completeness. The Project Board have subsequently indicated that they do not want to progress this option.

Concessionary single adult fare information is currently provided by all bus operators to Transport Scotland for the management of the concessionary fare scheme. It is believed that Transport Scotland have investigated sharing this with Traveline Scotland previously, but decided not to progress this, due to concerns about the

fare limitations, accuracy of the data and that authorisation would be need from operators to share this information.

Authorisation can be sought by contacting each bus operator and asking permission to reuse the supplied information for TLS data provision. It is anticipated that this permission would be easily granted if it were to benefit the operator by removing a process they need to manually undertake.

Processes would need to be put in place to ensure that Transport Scotland always have the latest fares information from operators i.e. get provided with new fare data when it changes. It is anticipated that Transport Scotland would also benefit from this approach in managing the concessionary scheme.

An SFTP site could be maintained by TLS or Transport Scotland for data submission from the bus operators. Submissions could be automated from the operator or manually undertaken through a web browser interface for example.

It is anticipated that there would be extra manual processing required by the Traveline Scotland Data Management supplier Trapeze to process even the basic adult fares for all bus operators (10% of adult single fares are currently not processed - for many smaller operators). Expected processing is around the service matching of bus stops and the data quality checks undertaken.

This option would only address the bus sector (as that is what is required to manage the concessionary scheme) and not the other modes where fares data is currently not shared, such as for air.

This option would not work for night services which are not eligible for concessionary fares.

5.3.2 Static fares provision

Processes would need to be put in place to ensure that the latest fares information is captured from all bus operators based on the single adult fare initially. The Adult fare is considered the easiest fare to provide as it is commonly understood in the context of the concessionary fare scheme. Interpretation of customer types need to be standardised by the journey planner, for example definitions of student, under 18, under 16, etc. This will allow customer preferences to be reflected in the ticket results presented.

The project has clear ambitions of including more than just adult fares, therefore a common understanding of concessionary (passenger) types and eligibility criteria is essential. A standard definition for the journey planner of adult, child (age range), other age restricted tickets would be a good starting point. NeTEx is expected to handle many of the complexities in the future so this project should not attempt to duplicate this. This is not an attempt to standardise on operator product offerings, just a way of ensuring that options are presented that are applicable to the passenger(s) travelling.

An SFTP site should be maintained by TLS for data submission from the operators. Submissions could be automated from the operator or manually undertaken through a web browser interface for example. Each operator would have their own SFTP account removing need for email provision of data.

It is anticipated that there would be extra manual processing required by the Traveline Scotland Data Management supplier Trapeze to process even the basic adult fares for all bus operators. Standardisations or simplifications to the file formats expected would be required to prevent handling of significantly more data becoming an issue.

This option is only applicable to the bus sector and not the other modes where fares data is currently not shared, such as for air.

In addition, multi-operator/mode zone cards such as Grasshopper, Zonecard, One Ticket and ABC are not currently promoted as alternatives to walk-up fares through the Traveline Scotland journey planner (a TLS project is underway to alert users to the existence of a multi-operator schemes for bus only.) Where journeys intercept the zonal boundaries applicable to multi-operator/mode tickets, the fare allocation service should offer the zone card as an option. A mechanism for describing these zonal regions and fare structures is needed to support their promotion within the fare allocator.

If an operator had a very simple service and fare structure, it is envisaged that a web portal could be provided to them for purposes of maintaining their fare data. An example of such an operator would be a small ferry operator providing a river crossing. Such a web site would require operator logon and a user interface to capture core details and allow the fare triangle to be defined. Once committed, this web site could provide a suitably formatted input file to the TLS data management function for inclusion in the static dataset which would include journey planning and fares lookup. Some workflow and approval processes are proposed to allow a submission to progress to public information.

5.3.3 Real time

Considering that the rail and airline industry already operate a real-time pricing system to support advanced fare and demand-based pricing models, it would be sensible to look at the same approach for the other transport modes. Existing rail and airline systems should be reusable but called from Traveline Scotland web site.

As per the previous option, single adult fare would be the first fare to be implemented as it is the best defined. The same level of ticket type definitions would be required as would the standards simplification. At this point, other fare types can be included in the results.

For the modes such as bus that do not provide real-time pricing there is appetite from some suppliers in providing such an API which would be preferable to operators exporting fare information in files. Additional fares would be captured from suppliers covering more operators, such as express coach fares. Where suppliers were not able to provide such APIs, the existing model of capture and storage of static fare data would be required. A registry of operator and real-time API can be used to identify which operators do not have an API and therefore default to static data.

The approach to real-time queries can be applied to demand responsive services such as ride-share and schemes such as bike share. In these cases, the service provider would price a journey from “origin” to “destination” and they could use their own formulas to establish price. The service provider would need to implement the server side to the real-time fare lookup API.

It has been commented that real-time fare lookup does not allow a journey to be found for a ticket. Admittedly, the scenario for this is unknown. This study recommends that should this scenario be found; a mechanism could be established using a new set of APIs that allows an operator to be queried for available tickets and a route query service provided for a given ticket. Until this is required, Fujitsu recommend continuing with the well-defined use cases.

The commercial model around provision of an API needs to be considered, as well as request speeds, resilience and costs. Suppliers are concerned about query load on their systems, especially if third parties outside of Traveline Scotland are to use the APIs and therefore bring significant load onto their systems. Introducing the service gently would allow these demand management queries to be understood.

Traveline Scotland can externalise APIs to broker queries for all travel modes aggregating the underlying real-time queries as part of the service. This could be expected to deliver the following benefits over time:

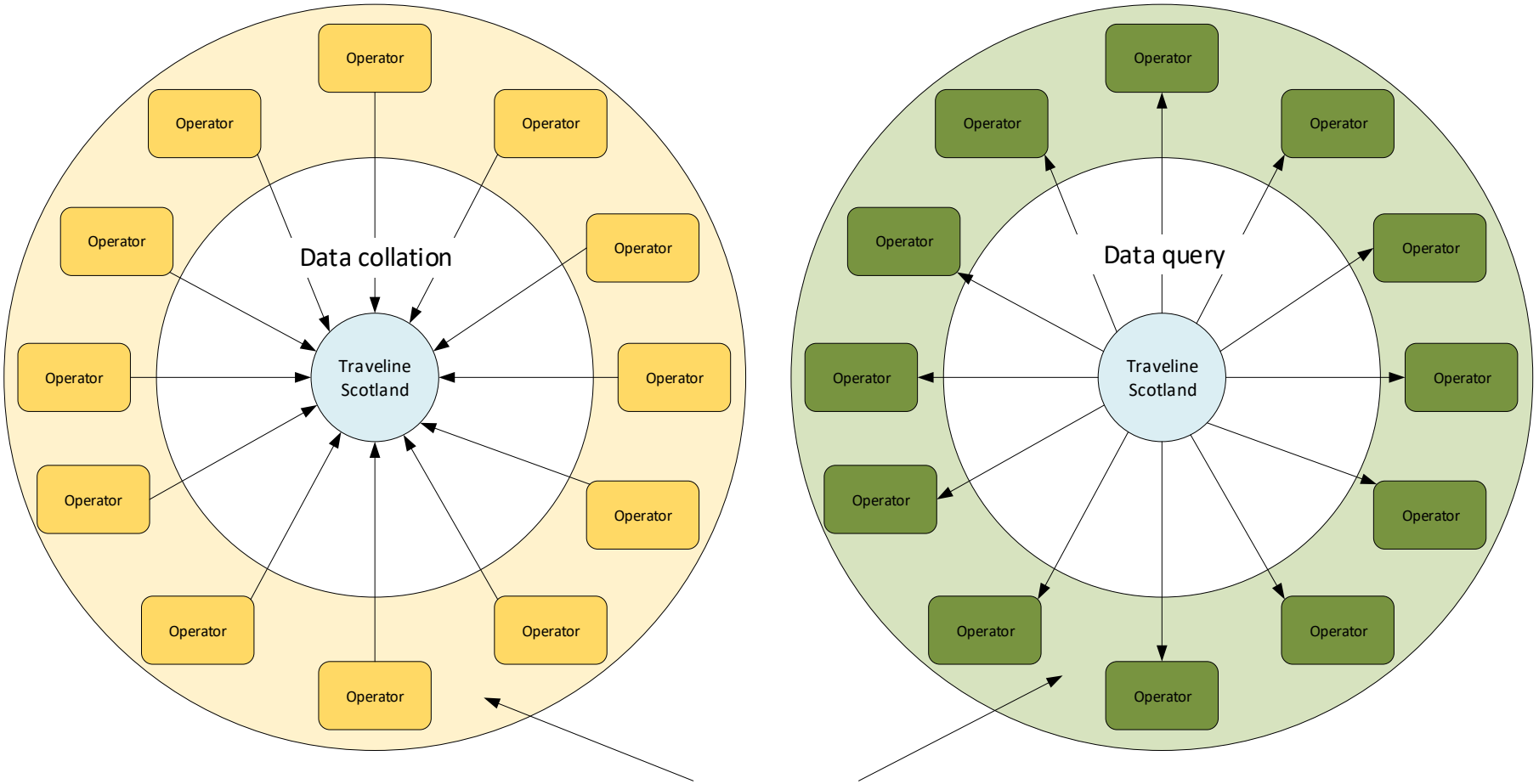
- Revenue to TLS through externalising APIs under a charging model.
- Customer access to journey planning and fares information via 3rd party applications.
- Increased use of public transport in Scotland.

The following diagram illustrates the point about ticket complexity. The notes below help describe the diagram:

- The perimeter of the diagram containing the operators is where the ticket complexity is encoded. This is where ticket issuing, validation, advanced purchase, walk-up scenarios, peak time considerations, multi-trip passes, and multi-day passes are all encoded. This complexity allows for competitive innovation.
- The left, yellow disc describes the current model whereby fare data is collated centrally. In this situation, the complexity needs to be described and provided to TLS as data aggregators such that it can be presented when queried by the journey planner.
- The right, green disc describes the model proposed for this stage which is to perform real-time queries out to the operators where APIs are available. This leaves the complexity at the periphery with the operators. The right ticket fares will be returned by the operator for a given query.

Aggregation of fare data – centralised complexity

Real time query of fare information – distributed complexity



Ticket validity complexity

5.4 APIs and standards involved

For options 1 (reuse concessionary fares) and 2 (static fares provision), there is no defined standard for the provision of fare data to TLS. This results in "whatever is available" files being provided and processed by the data management function of TLS. Some operators are better than others and many use a standard fare triangle-based export provided by their ticketing system supplier (Vix and Ticketer).

A UK profile of the NeTEx XML schema is being developed as a standard (funded by DfT) for describing fare data. NeTEx will accommodate the complexities of UK bus fares and will be delivered in phases starting with the simpler fare structures. There is no benefit to Transport Scotland, TLS or the industry in defining an additional but different file format to NeTEx. The Aggregator project can only suggest that small improvements are made to the current files being submitted to TLS to simplify the processing burden.

Note that using a real-time query-based system as per option 3 (real time pricing), removes the need for complex fares to be described in a file format and provided to Traveline Scotland. The operator will perform the (complex fare) validation and return only valid tickets for the given criteria.

The following table details considerations on fare data sharing for each transport mode.

Transport mode	Fare sharing considerations and applicable API standards
Bus	All operators (or ticketing system providers) currently providing fare information to TLS do so by providing an export of a fare triangle. The format of these vary. Some have multiple services expressed as multiple worksheets in an Excel spreadsheet. Others have a single service in a single spreadsheet. Some express return and child fares as a formula from adult fare. Others include lookup takes to translate adult fare into child. Some examples encode zonal information, some use fare stages, some just stage number. All examples provided by Traveline to this study, use a "known as" name for the bus stop rather than the assigned Naptan code. This shows the intended use of this export for printed fare information rather than data exchange. For example, Ashwood Terminus would be more accurately defined as 23236492. When a machine to machine file format is being used, it would be easier to reference Naptan to avoid interpretation issues e.g. there will be multiple "George Streets" or multiple "Opposite Asda" descriptions. This would reduce the Naptan processing effort needed by the TLS Data Management function when services are changed. In addition, there are some (bus) stop bus locations that do not have an allocated Naptan reference. These might be disputed bus stops or informal drop offs. For these cases, it would be very useful to refer to the geo-coordinates of the stop. This will provide an absolute location that could be used in journey planning etc. There is useful information that can be provided in addition to fares indicating what payment forms are accepted on bus. This can be provided to customers as enhanced static data overlays. Some bus operators and ticketing system providers have indicated that there are APIs that could be exposed to allow real-time pricing of services. This would remove the need to provide data aggregation services for some operators' fare data.
Tram	Tram is modelled as a fixed route bus service so any standardisation for bus would be applicable to Tram. Tram stops are identified with Naptan codes.
Subway	Subway is modelled as a fixed route bus service so any standardisation for bus would be applicable to Subway. It should be noted that the Subway fare structure is very simple.
Ferry	Ferry can be modelled as a fixed route service with fixed pricing. Any standardisation for bus would be applicable to Ferry including support for Naptan codes. It is possible for dynamic pricing to be obtained through Ferry booking systems where supported.
Rail	Dynamic pricing through existing RDG National Rail Reservations system.

Transport mode	Fare sharing considerations and applicable API standards
Air	Airlines have APIs that can be used by 3rd parties for price retrieval.
Cycle	Cycle share schemes usage is priced by time slot, not distance or point to point. Information can be provided on real-time availability of bikes in the network through existing well documented APIs, with an appropriate process to manage any API changes. A journey planner should be able to consider the coverage of a cycle scheme as a user selected option and have sensible settings for what an acceptable distance ride might be. In this way, cycle can be offered as a credible mode for a segment of a journey where the cycle station is closer to a destination than a bus stop or railway station. Cycle schemes do not allow for reservation of bikes therefore there is no way of providing advanced purchase of bike usage. In addition, the cycle schemes require registration and payment checking for deposits as they provide assets for customers to take away and use. Certainly, knowing the location of cycle stations, rough costs and links to register in advance will improve the accessibility of such schemes.

A real-time query on price would have the following form:

Inputs	Outputs
Operator of service Service identifier Start date and time of journey Origin and origin type e.g. Queens St station, NLC code. Destination and destination type	One or more leg options including: Fare options for adult, child, concessionary, student, etc. Scheduled date and start time of service.

Describing this pattern, a customer would specify when and where they wish to travel and for each journey leg planned, a price will be shown for each concessionary class (e.g. Adult, Child, Student).

5.5 Use case alignment

An assessment of how well each option aligns with the user preferences for each of the use cases is detailed below using the scoring Low 1, Medium 2, High 3. The scores are summed to provide the best overall option from the point of view of the potential users. For this assessment, it is also assumed that each use case has equal weighting.

Customer use case	Option 1(reuse concessionary fares)	Option 2 (static fares provision)	Option 3 (real time pricing)
Local city commuter	1	2	3
Inter-city commuter	1	2	3
Business traveller to Scotland	1	1	3
City off peak day leisure/retail visit	1	2	3
Domestic tourist walking trip	1	2	3
Foreign tourist	1	1	3
Hospital visit	1	2	3
Traveller with no detailed knowledge of public transport	1	2	3
Low income commuter with disrupted journey	1	2	3
Student in further and higher education	1	2	3
Rural traveller	1	2	3
Islands resident regular traveller	1	2	3
Totals:	**12**	**22**	**36**

Option 3, real-time API provides the best solution alignment for the use case scenarios.

5.6 System development effort

For each of the options for stage 1, a high-level assessment has been made of the industry system development effort. These are generalised efforts across operators (and suppliers) and Traveline Scotland.

The effort scores have been estimated by allocating weightings of Low 1, Moderate 10. Whilst option 3 (real time pricing) is estimated to be more effort than the other two options, not all options are equal regarding the benefits they bring. Please refer to the following benefits section.

This stage is looking at enhancing the fares information and therefore will fit into the existing user interfaces for both web site and mobile app where prices are already displayed.

Option	Task	Effort
1 reuse concessionary fares	Operator system changes to support improvements to fare triangle submission format in advance of NeTEx.	Moderate
	Establish file hosting service (sFTP) to allow operators to submit fare information once and it can be used by both Transport Scotland and TLS.	Low
	Transport Scotland changes to support file format changes in advance of NeTEx.	Moderate
	TLS changes to support file format changes in advance of NeTEx.	Moderate
	TLS changes to support processing of increased fares information from operators.	Moderate
	Effort score	**41**
2 static fares provision	Operator system changes to support improvements to fare triangle submission format in advance of NeTEx.	Moderate
	Establish file hosting service (sFTP) to allow operators to submit fare information to TLS.	Low
	Additional operator processes to support providing fares information to TLS where they are not doing so already.	Low
	TLS changes to support file format changes in advance of NeTEx.	Moderate
	TLS changes to support processing of increased fares information from operators.	Moderate
	Effort score	**32**
3 real time pricing	Rail - Integrate real-time pricing API into TLS journey planning results presentation.	Moderate
	Air - Integrate real-time pricing API into TLS journey planning results presentation.	Moderate
	Bus – Integrate real-time pricing API into TLS journey planning results presentation were APIs available.	Moderate
	Ferry – Integrate real-time pricing API into TLS journey planning results presentation were APIs available.	Moderate
	Revert to static price lookup where real-time pricing API not available.	Low
	Operator system changes to support improvements to fare triangle submission format in advance of NeTEx.	Moderate
	Establish file hosting service (sFTP) to allow operators to submit fare information to TLS.	Low
	Additional operator processes to support providing static fares information to TLS where they are not doing so already.	Low

Option	Task	Effort
	TLS changes to support processing of increased fares information from operators.	Moderate
	Effort score	**63**

In addition to the above tasks, system development effort is expected to provide APIs to external 3rd parties to consume journey planning and fare lookup services. This effort is independent of the option selected. This work is considered to be moderate but with an emphasis on API management, security, rate limits, etc.

5.7 Benefits

For each of the stage 1 options, anticipated benefits are listed and scored below using scoring as None 0, Low 1, Medium 2, High 3. This has been based on the Discovery assessment benefits work.

Benefits category	Benefit	Option 1 (reuse concessionary fares)	Option 2 (static fares provision)	Option 3 (real time pricing)
Fares data	Consistent bus fares data exchange formats in advance of NeTEx.	0	1	1
	Complete upload of bus operator fares data for TLS Data Management	0	1	2
	More efficient TLS fares data management	0	1	3
	Complete fares data across transport modes	0	0	3
	Support for best value fares, advanced purchases	0	0	3
Customer	Increased provision of online fares information	1	1	2
	'One stop shop' for ticket purchasing across transport operators and modes	0	0	0
	Easy, standardised and cashless customer experience	0	0	0
	Customers can purchase 'there and then' on app	0	0	0
	Increased smart integrated ticketing take up across all transport modes	0	0	0
	Increased journey planning information for cycle schemes and DRT	0	0	0
	Improved first and last leg multi-modal journey planning	1	1	3
Operator	Greater pre-payment for integrated ticketing	0	0	0
	Modal shift from car to cycle schemes	1	1	1
	Greater customer marketing opportunities	0	0	0
	Revenue switch to public transport for new and occasional customers	0	1	1
	Contribute to rail smart ticketing obligations	0	0	0
	Cash handling reduction	0	0	0

	More efficient and automated back office operations	0	0	2
	Quicker bus boarding times [though more informed passenger]	0	1	1
	Totals:	**3**	**8**	**22**

Option 1 had the potential to provide coverage across all bus operators due to all participating in the national concessionary fare already. It does however only cover the adult fare so has been scored lower in terms of benefits. Options 2 and 3 will require operator participation to obtain coverage therefore there is the possibility that 100% will not be attained.

From the above scoring, option 3, real-time pricing through APIs, can be expected to deliver more benefit than either options 1 and 2.

5.8 Alignment to strategy

The proposed solution should align to the overall Scottish Ministerial vision to support customer-focused, multi-modal, multi-operator smart ticketing system across Scotland.

In addition, the Aggregator solution should align to the Transport Scotland 'Smart ticketing and payments delivery strategy'. An assessment of the proposed Aggregator solution options against the delivery strategy goals is detailed in the table below.

The following goals have been scored using scoring None 0, Low 1, Medium 2, High 3.

Strategic goal	Option 1 (reuse concessionary fares)	Option 2 (static fares provision)	Option 3 (real time pricing)
That all journeys on Scotland's bus, rail, ferry, subway and tram networks can be made using some form of smart ticketing or payment	0	0	0
Increase the smart ticketing and payment offering and take up across all transport modes	0	0	0
Increase smart ticketing interoperability across operators and modes	0	0	0
Encourage a higher level of consistency in the smart ticketing customer proposition for members of the public	0	0	0
Improve the provision of online ticketing and fares information along with the range of smart retail and payment options	0.5	1	2
Simplify and improve access to the right price for customers through improved information and ticketing options	0.5	1	3
Increase the number of operator/local authority/regional transport partnership smart ticketing or payment schemes implemented, to meet local needs	0	0	0
Ensure successful continuation of concessionary travel as an ITSO smart interoperable scheme	0	0	0
Facilitate as wide as possible use of a standardised platform for all public transport providers, with the purpose of bringing true interoperability	1	1	1
Totals:	**2**	**3**	**6**

Option 3 provides a greater alignment with the overall Transport Scotland smart ticketing and payment goals. This is given that the focus of this option is on real time pricing, whereas the goals are largely focused on smart ticketing.

5.9 Risk assessment

An assessment of risks together with mitigating actions relating to stage 1 options is detailed below.

The risks have been identified, based on discussions with suppliers and operators during the assessment and recommendations stages. The risks relate to the achievement of the desired benefits for the recommended options for each of the 3 stages in this report.

Option ref.	Risk category	Risk	Risk description	Impact/ probability	Risk mitigation
3 real time pricing	Operator adoption	Small operators will require funding to implement proposed changes.	Investment may be required by operators to enable APIs for real time pricing. If they are not to provide real-time information but continue to (or start to) provide fare information to TLS, they will need processes to support this. See section 14.1 for more details.	Medium/ High	External funding and support may be required for small operator process and technology improvements effort. There is a fall-back of static fare provision if real-time API was not considered suitable for an operator.
2 static fares provision 3 real time pricing	Customer adoption	People migrate to other 3rd party journey planners such as Google Transit, Moovit & Citymapper rather than Traveline for travel info	Customers may use other 3rd party journey planners in preference to TLS for journey planning. This project is concerned about improving the public transport experience through Traveline Scotland but if public are using non-Traveline Scotland services then there is less control that can be applied.	Medium/ Medium	Marketing may be needed to publicise the TLS journey planning enhanced capabilities on companion sites such as Visit Scotland, Scotland.org, etc. Marketing will be required to promote the use of TLS journey planner outside of Scotland. If TLS provide the static data to inform other 3rd party journey planners searches, there should be broad alignment (from the public perspective) over results from both organisations. This would be of overall benefit to public transport. However, there may be a time lag in information being updated on 3rd party journey planners and the TLS journey planner maintains some information such disruption, which is not available in other 3rd party journey planners.
2 static fares provision	Fares standards	Supplier fares standards	Until NeTEx is implemented by the industry, suppliers and	Medium/ High	Sponsorship by Transport Scotland.

Option ref.	Risk category	Risk	Risk description	Impact/ probability	Risk mitigation
			national operators do not wish to implement another standard.		Having a machine to machine interface will remove the need for manual operator processes. Recommended interim fares data improvements such as NAPTAN matching. Having a real-time interface will remove any need to cut over to NeTEx from operators to Traveline Scotland for data exchange.
2 static fares provision	Operational	TLS data management	TLS Data Manager function is not expected to scale easily to 100% fare coverage where additional manual processing is required for operators (I.e. where real time pricing APIs are not possible).	Low/ Medium	Implement interim file format improvements such as Naptan matching to reduce processing effort. Ensure that the solution strives for best practice un-attended automation of data processes for operators.
2 static fares provision 3 real time pricing	Fares standards	Fares complexity	Fares system complexity prevents fares enrichment.	Medium/ Medium	Ensure that the solution for real time fares enquiries is adopted where possible. Complexities can be hidden inside of operator implementations rather than having to be understood externally.
2 static fares provision	Fares standards	Customer types (e.g. Adult/ Child/ Student)	Inconsistent definition of customer types across the country make it difficult to mix and match pricing from different operators and/or modes.	Medium/ High	Start with Adult fare as this is well defined through the concessionary bus scheme. Look to support adult fares across all operators before all fares for some operators. Define other customer types such that all operators agree on the journey planner interpretation. This can be based on Saltire card definitions. Look to support all fare types other in addition of adult.
3 real time pricing	Operational	TLS dependency on external systems for provision of service	If TLS were to be performing real-time queries on operator systems, there is a system availability expectation for TLS to	Medium/ Low	Operator systems will be receiving queries from other systems so this should be standard operational activity for them. SLAs and performance metrics would need to be agreed, measured

Option ref.	Risk category	Risk	Risk description	Impact/ probability	Risk mitigation
			provide their own service to the public.		and monitored, especially if access to these APIs is being charged. Caching of results can reduce the load on external systems dramatically. Pricing models for API usage can be engineered to pay for successful calls and get credits for unsuccessful calls. It is therefore in the interests of the API provider to have high availability.

These risks are applicable to all options and are not anticipated to influence one option over another.

5.10 Recommendation and schematic

The use case alignment, benefits, strategy alignment, risks and development effort have been considered to build the recommendations in this section. There are no tasks listed in the system development effort section that were classified as high effort.

Option 1 (reuse concessionary fares) has been discounted due to concerns raised by Transport Scotland over the suitability of this data for the wider aspirations. It was included for completeness, as it had been mentioned by several operators and suppliers as a route for fare data.

Fujitsu has based our recommendations on the assessments performed and our professional judgement. Option 3 (real time pricing) is the best fit for strategic aspirations as well as customer benefits and therefore worthy of the increased effort associated with its implementation. It is anticipated that not all operators can provide data through real-time APIs therefore the fall back of static data provision is still required. Based on this assessment, the recommendations are as follows, in order of suggested implementation:

a) Define all customer types[1] for the journey planner such that there is a common understanding across all operators. Note should be taken of the comments in section 5.3.2 about not replicating NeTEx.

b) Publish a specification for a fares interchange format based on fares triangles that can encode multiple customer and ticket types and use machine friendly stop references such as Naptan. This will not attempt to encode all the ticket validity complexities. This approach is merely a method of easing the burden on the TLS data management function processes when increasing the number of fare files received and is potentially a long term stop-gap until NeTEx is fully supported by suppliers.

c) Publish a specification for the formal description of multi-operator zonal tickets and other products such as the Freedom of Scotland Travelpass, that can be used by the fare allocation service when presenting fare options.

d) Request all operators provide a real-time API, if possible, through their own IT platform (known preference of one operator) or through their supplier's platforms. This will involve API definition that will be provided by the technical specification phase of this project. Alternatives to this real-time API are to provide fare data as it changes using the previously mentioned file format (b). This will be processed and stored by Traveline Scotland and used to provide static data results. This means operators can choose between providing an API or providing fare data in the new format (b) every time it changes.

e) Undertake integration of real-time fare lookup with operators for adult fare. This will involve either the integration with existing fares APIs (e.g. in the case of rail) or operator [supplier] implementation of a fare lookup API and Traveline integration with this. Traveline Scotland systems will be extended

[1] Customer type is used to refer to adult/child/student/disability/elderly. It is also known as "concession type".

with a registry of operator API end points that will direct fare lookup queries to the appropriate operator implementations.

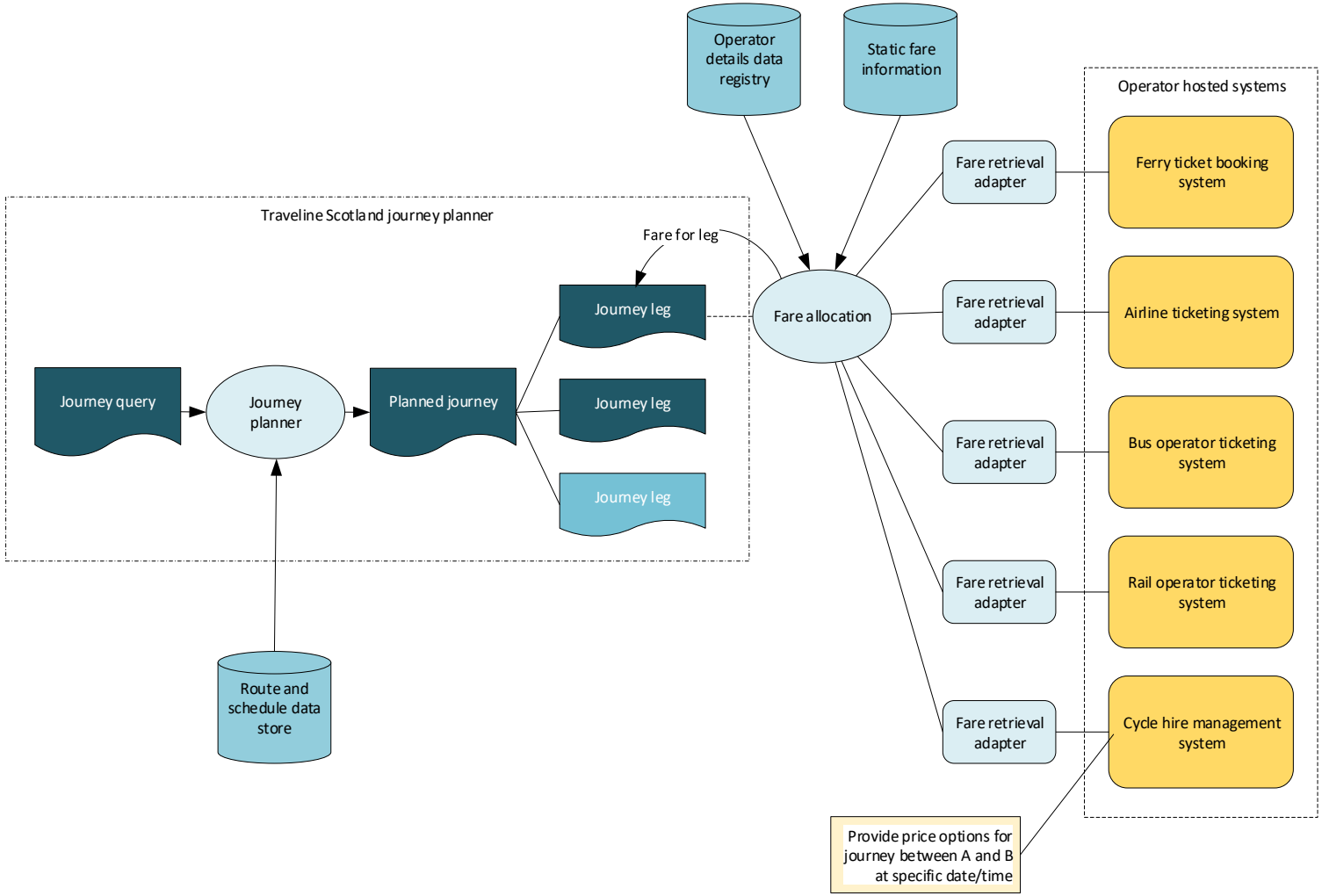
f) Extend the real-time API to support fares other than adult. This is an implementation recommendation and not a design restriction.

g) Consider providing additional support to smaller operators to address the willingness to participate in the Aggregator stage 1 recommendations. See section 14.1 for more details on operator participation willingness assessment.

h) Implement external API to allow 3rd parties to make use of aggregated fares service provided by Traveline Scotland.

Operator ticketing systems are considered to be the “operator assets” that need to be integrated to support either option 2 or option 3 above. These are typically hosted and managed on behalf of an operator by a supplier. Example suppliers include Trainline, Ticketer, Flowbird and Hogia. A more detailed assessment of operator ticketing systems is contained in the Discovery assessment report.

These recommendations are illustrated in the following diagram which shows how a journey query is processed by the journey planner into a planned journey consisting of legs. Each leg can be priced by a process that uses registry information to determine the best source of fare data. This can be static data or a real-time enquiry onto the operator. Please see process follows in section 9.1.



6. Stage 2 retail hand off: assessment of options and recommendations

An assessment of options and recommendations relating to the integrated fares and ticketing solution design for stage 2, is detailed in the following sections.

6.1 Stage 2 description

The options assessed will need to address the scope of stage 2 which is summarised below:

- Ticket purchase hand-off to operator web site from journey leg result.
- The operator takes payment and issues ticket, using their own preferred ticket media.

These have previously been described as API “lite” integration as oppose to API “full” integration which is stage 3.

6.2 Stage 2 options

Based on the Discovery requirements and assessment work, a couple of Aggregator solution options have been identified for Stage 2, as summarised in the table below:

Ref	Option name	Option description
1	Ticket purchase hand-off to operator web site.	Ticket purchase hand-off to operator web site, with ticket purchase traffic driven to operator for operator to retain payment capture. There would a separate hand off to each operator for a multi leg journey (when online tickets are retailed). This is different to a “basket” approach as the user would have to open each retail link individually. Ticket options and price information would be displayed to the customer using existing approaches (supplemented by stage 1). When the customer has selected the best option for them, they would progress to purchase using the hand-off mechanism. Operator delivers ticket using existing media e.g. smart / mobile / print at home paper. There are no standards for this type of hand-off other than standard web technologies – some suppliers are known to have specifications in this space. An adapter may be required for each site to be handed off to (an adapter is software that allows an interface of an existing class to connect to another interface, this will be used to connect to existing APIs where available and suitable). The approach is considered a quick win although some conflict between bus and rail anticipated unless all parties have such a hand-off mechanism. Existing hand-off techniques used in rail and airline industries should be used. E.g. National Rail Enquiries or Skyscanner.
2	Provide additional information on options	Enhance information presented to the customer as static overlays on TLS journey planner (in addition to the TLS static overlays currently provided). This should include what payment options are available on bus e.g. cEMV, cash (no change), etc. Information on zonal ticketing schemes, cycle schemes, on-demand transport services (DRT like) can be displayed.
3	Undertaken both activities listed above as they are not exclusive	Implement both enhanced information overlay and retail hand off.

6.3 Technical and business considerations

For each of the stage 2 options, technical and business considerations have been described below.

6.3.1 Ticket purchase hand-offs to operator web sites

Using National Rail Enquiries http://www.nationalrail.co.uk/ as an example, a journey can be planned from any rail station to any rail station in the UK. Journey options are presented with a "Buy" button that will redirect to a TOC retail web site. The default TOC is the one primarily providing the service however any TOC web site can be selected to be used, allowing existing accounts or loyalty programmes to be used. In this model, there are several suppliers of WebTIS (Web Ticket Issuance System) and National Rail Enquiries knows how to "hand-off" purchases onto them, with operator taking payment and fulfilling the ticket using their existing infrastructure.

Applying this model to TLS will involve knowing the ticket retailing web site for each operator wishing to participate. An adapter is anticipated for each different web operator site. The adapter understands how to construct a URL or create a HTTP POST request that will inject the correct ticket options on the operator retail site.

Existing mechanisms for this will be reusable from airlines and for ScotRail. At least one bus operator has a retail web site that is suitable for this hand-off approach from external inspection. Other operators or their suppliers will need to be engaged to establish a hand-off mechanism to support this model.

The following table shows the variety of website systems that would need to be interfaced with to allow hand off for operator retail.

Transport mode	Operator website providers
Bus	Variety of in-house developed, agency developed, and transport system provider managed ecommerce websites are in use across the bus industry. There is little commonality.
Tram	In-house
Subway	Transport system provider.
Ferry	Combination of ferry booking systems combined in some cases with inhouse IT systems including website.
Rail	Transport system provider.
Air	Airline industry providers.
Cycle	In-house websites and systems with well-defined public APIs for open data sharing.

It should be acknowledged that very few small operators have websites supporting online retail whereas all large operators have such systems in place. This option will therefore benefit the larger operators disproportionally. See section 6.8 risk assessment.

6.3.2 Additional information on services

It has been identified that providing additional information regarding the purchase options available and useful information about using services would be of benefit to the public and could be delivered as a 'quick win'. Examples include:

- Knowing that exact fare is required on a bus.
- Knowing that cEMV cards can be used to pay for tickets and can be used when exact fare not available.
- Knowing that buses need to be hailed (or not).
- Knowing that stop requests need to be made by pressing the button to notify driver. I.e. bus may not automatically stop at every stop.

The above points are considered important in removing the barriers for adoption of public transport. Having a bus pass a stop as it was not hailed is not a great introduction to travelling by bus.

There are levels of information that can be overlaid against the operator and the specific service being operated. The following table expands the points above with examples.

Information point	Example operator information	Example service information
Cash fare for tickets	Exact fare only, no change given	
Weekly tickets	Can be purchased on bus	
Monthly tickets	Can be purchased online	
Bus hailing from road		Service can be hailed
Bus stop request from onboard		Stops can be requested by pressing the "stop request" button onboard. Remain seated until bus comes to a halt.
Next stop audio		Bus will automatically announce the next stop, 2 minutes prior to arrival.
Card payment	Contactless bank cards accepted on all services.	
Wheelchair access		Accessible buses are equipped with low floors and ramps can be deployed to assist access.
Environment	All buses in service are classified as ultra-low emission vehicles.	

A file format shall be designed to allow for such information to be provided at both operator and service level, with common terminology. This will take the form of tag/value pairs (or table columns) attributed to operator and overwritten by service. The TLS data management processes will incorporate this information into their static data overlays (in addition to the TLS static overlays currently provided) such that information can be presented alongside journey planning results. It is anticipated that an existing situation console CSV file format can be extended to support the above information. Provision of CSV files via an SFTP site would all for automatic inclusion of data in the data factory builds.

The above information description is specific to bus / coach services. A more general conditional information overlay would allow for relatively complex rules to be constructed based on geographical regions (zones) and planned journey. This could provide additional marker-based information, additional payment information, etc.

Example include:

- Information about demand responsive transport services (DRT) or "book by mobile app" services like ride sharing that may operate in a geography.
- Zonal and multi-operator ticketing schemes.
- Definitions of cycle share schemes, their operating boundaries, registration information, etc.
- Retail information such as special offers, visitor information, special attractions, etc.

This type of zonal overlay is expected to define a geographic region, have some logic to determine whether information should be displayed or not and the information to display.

6.3.3 Ticket purchase hand off and additional information overlay

The previous two options are not mutually exclusive therefore it is possible to implement both.

6.4 Use case alignment

An assessment of how each solution option aligns with the use cases, is detailed below, which have been scored using None 0, Low 1, Medium 2, High 3.

Customer use case	Option 1 (purchase hand off)	Option 2 (overlay information)	Option 3 (options 1+2)
Local city commuter	1	1	1
Inter-city commuter	2	1	2
Business traveller to Scotland	2	2	2
City off peak day leisure/retail visit	2	2	2
Domestic tourist walking trip	2	2	2
Foreign tourist	2	3	3
Hospital visit	1	1	1
Traveller with no detailed knowledge of public transport	2	3	3
Low income commuter with disrupted journey	1	1	1
Student in further and higher education	1	1	1
Rural traveller	2	1	2
Islands resident regular traveller	1	1	1
Totals:	19	19	21

As option 3 is the implementation of both options 1 and 2, it has been scored as the best of both constitute options.

Both ticket purchase hand-off and information enhancement are considered beneficial to all use cases. This is based on the premise that more information and more options to buy are better than less.

6.5 System development effort

For each of the options for stage 2, a high-level assessment has been made of the industry system development effort, in TLS and third parties implementing the solution options.

The effort scores have been estimated by allocating weightings of Low 1, Moderate 10.

Option	Task	Effort
1 purchase hand off	Establish hand-off protocol with operator web site supplier and document. This is to be repeated for each web site to be interfaced with. Existing hand-off protocols may be in place e.g. Trainline. Others are simple to backwards engineer e.g. Stagecoach.	Moderate
	Develop adapter to support hand-off to operator for each website/system identified above. These are not considered to be complex, a translation of origin, destination, date/time information is required to a format specific to the target web site.	Moderate
	Augmentation of operator information registry containing details relating to how to hand off to operator web sites. It is acknowledged that this would be an extension to existing operator registry.	Moderate
	Provide purchase links from planned journey leg results to online retail through adapter via a button. It would be recommended to open the operator retail site in a new browser tab. This work is assumed to cover both web site and mobile app development.	Moderate
	Provide mechanism to record telemetry on hand-offs for reporting purposes.	Low
	Effort score	**41**
2 purchase information	Publish file format for providing additional static operator and service information to TLS from the operators.	Low
	Operators to complete files for themselves and their services and return to TLS. This would need to be done by all operators.	Low
	Public file format for providing zonal overlay information	Low
	Stakeholders wishing to take advantage of zonal overlay information to provide necessary information to Traveline Scotland such that a zonal overlay can be built.	Low
	User interface work on both web site and mobile app to include additional information to customer. This will require a degree of UX/UI work to ensure presentation is not cluttered. Task is marked as “Moderate” in anticipation of some good UX work being needed to improve the display of results and associated information.	Moderate
	Effort score	**14**
3	**Effort score taken as sum of previous**	**55**

6.6 Benefits

For each of the stage 2 options, anticipated benefits are listed and scored below using scoring as None 0, Low 1, Medium 2, High 3. This has been based on the Discovery assessment benefits work.

Benefits category	Benefit	Option 1(purchase hand off)	Option 2 (purchase information)	Option 3 (options 1+2)
Fares data	Consistent bus fares data standards and operability	0	0	0
	Complete upload of bus operator fares data for TLS Data Management	0	0	0
	More efficient TLS fares data management	0	0	0
	Complete fares data across transport operators and modes	0	0	0
Customer experience	Increased provision of online ticketing and fares info	3	3	3
	'One stop shop' for ticket purchasing across transport operators and modes	1	0	1
	Easy, standardised and cashless customer experience	1	1	1
	Customers can purchase 'there and then' on app	0	0	0
	Increased smart integrated ticketing take up across all transport modes	0	2	0
	Increased journey planning information for cycle schemes and DRT	0	2	2
	Improved first and last leg multi-modal journey planning	0	0	0
Operator benefits	Greater pre-payment for integrated ticketing	1	0	1
	Modal shift from car to cycle schemes	0	1	1
	Greater customer marketing opportunities	1	2	2
	Revenue switch to public transport for new and occasional customers	1	1	1
	Rail smart ticketing obligations	0	0	0
	Less operator effort and cost in handling cash	1	0	1
	More efficient and automated operations	1	0	1
	Quicker bus boarding times	1	1	1
	Reduced bus operator dwell time costs	1	1	1
	Decreased operator costs	1	1	1
Totals		**13**	**15**	**17**

Both options 1 and 2 provide a contribution to the anticipated project benefits by providing additional travel information and purchase options from the journey planner. Option 3 being the implementation of both options 1 and 2 provide the most benefits.

6.7 Alignment to strategy

The proposed solution should align to the overall Scottish Ministerial vision to support customer-focused, multi-modal, multi-operator smart ticketing system across Scotland.

In addition, the Aggregator solution should align to the Transport Scotland 'Smart ticketing & payments delivery strategy'. An assessment of the proposed Aggregator solution options against the delivery strategy goals is detailed in the table below.

The goals have been scored using None 0, Low 1, Medium 2, High 3.

Strategic goal	Option 1 (purchase hand off)	Option 2 (purchase information)	Option 3 (options 1+2)
That all journeys on Scotland's bus, rail, ferry, subway and tram networks can be made using some form of smart ticketing or payment	0	0	0
Increase the smart ticketing and payment offering and take up across all transport modes	0	0	0
Increase smart ticketing interoperability across operators and modes	0	0	0
Encourage a higher level of consistency in the smart ticketing customer proposition for members of the public	0	1	1
Improve the provision of online ticketing and fares information along with the range of smart retail and payment options	2	2	2
Simplify and improve access to the right price for customers as a result of improved information and ticketing options	1	0	1
Increase the number of operator/local authority/ regional transport partnership smart ticketing or payment schemes implemented, to meet local needs	0	0	0
Ensure successful continuation of concessionary travel as an ITSO smart interoperable scheme	0	0	0
Facilitate as wide as possible use of a standardised platform for all public transport providers, with the purpose of bringing true interoperability	2	1	2
Totals:	**5**	**4**	**6**

Option 1, supported by option 2, provides some alignment with the overall Transport Scotland smart ticketing and payment goals, essentially as 'quick wins' prior to the implementation of the stage 3 solution. This is given that this stage focusses on deep-linking to operator websites and not ticketing, which forms most of the goals listed.

6.8 Risk assessment

An assessment of risks together with mitigating actions relating to stage 2 options is detailed below.

The risks have been identified, based on discussions with suppliers and operators during the assessment and recommendations stages. The risks relate to the achievement of the desired benefits for the recommended options for each of the 3 stages in this report.

Option ref	Risk category	Risk	Risk description	Impact/ probability	Risk mitigation
1 Purchase hand off 2 Purchase info	Technical	Lack of operator retail web sites.	Many smaller operators do not have retail websites and therefore retail deep linking from TLS journey planner would not be possible. This stage is likely to benefit larger operators disproportionally.	Medium/ High	Enhance data provided to the customer as static overlays on TLS journey planner. This will include what payment options are available on bus e.g. cEMV, cash (no change), bus etiquette and environmental impacts.
1 Purchase hand off	Operator adoption	Funding for small operators to implement deep linking for retail.	Investment may be required by operators to enable deep linking for retail hand-offs from TLS (for where tickets are retailed online).	Medium/ Medium	External funding and support may be required for small operator technology improvement. Some existing websites can support hand-off without modification.
1 Purchase hand off 2 Purchase info	Operational	Not all tickets available for purchase online. e.g. < 7 day	Many operator websites restrict availability of ticket options to 7-day (or greater duration) season ticket options.	High/ High	Enhance data provided to the customer as static overlays on TLS journey planner. This will include what payment options are available on bus e.g. cEMV, cash (no change).
1 Purchase hand off 2 Purchase info	Operational	Managing operators arriving and leaving service.	When operators want to join or leave the TLS arrangements for retail hand offs, a clear process will be needed.	Medium/ High	Implement a service management function in TLS to manage.
1 Purchase hand off 2 Purchase info	Customer adoption	People migrate to other 3rd party journey planners such as Google Transit, Moovit, Citymapper, etc rather than Traveline for travel info	Customers may use other 3rd party journey planners in preference to TLS for journey planning	Medium/ Medium	Marketing may be needed to publicise the TLS journey planning enhanced capabilities. If TLS are providing the information into other 3rd party journey planners, then any usage that leads to increased public transport usage is of benefit.

6.9 Recommendation and schematic

Fujitsu has based our assessment on the technical feasibility, business considerations, overall benefits, alignment to strategy, development effort and risk. Based on this assessment, the recommendations are that option 3 is followed with both options 1 and 2 being implemented as follows:

a) Support a mechanism for retail hand-off, as used in airline and rail industries, to allow tickets to be purchased from results generated by the TLS journey planner. There would be a manual (customer initiated) hand off to each operator for a multi leg journey (when online tickets are retailed).

b) Provide a mechanism for operators submitting information for use in static information overlays (in addition to the TLS static overlays currently provided) for both operator and service using a simple file format. This can include public access websites through to information on bus travel etiquette and environmental benefits of bus travel.

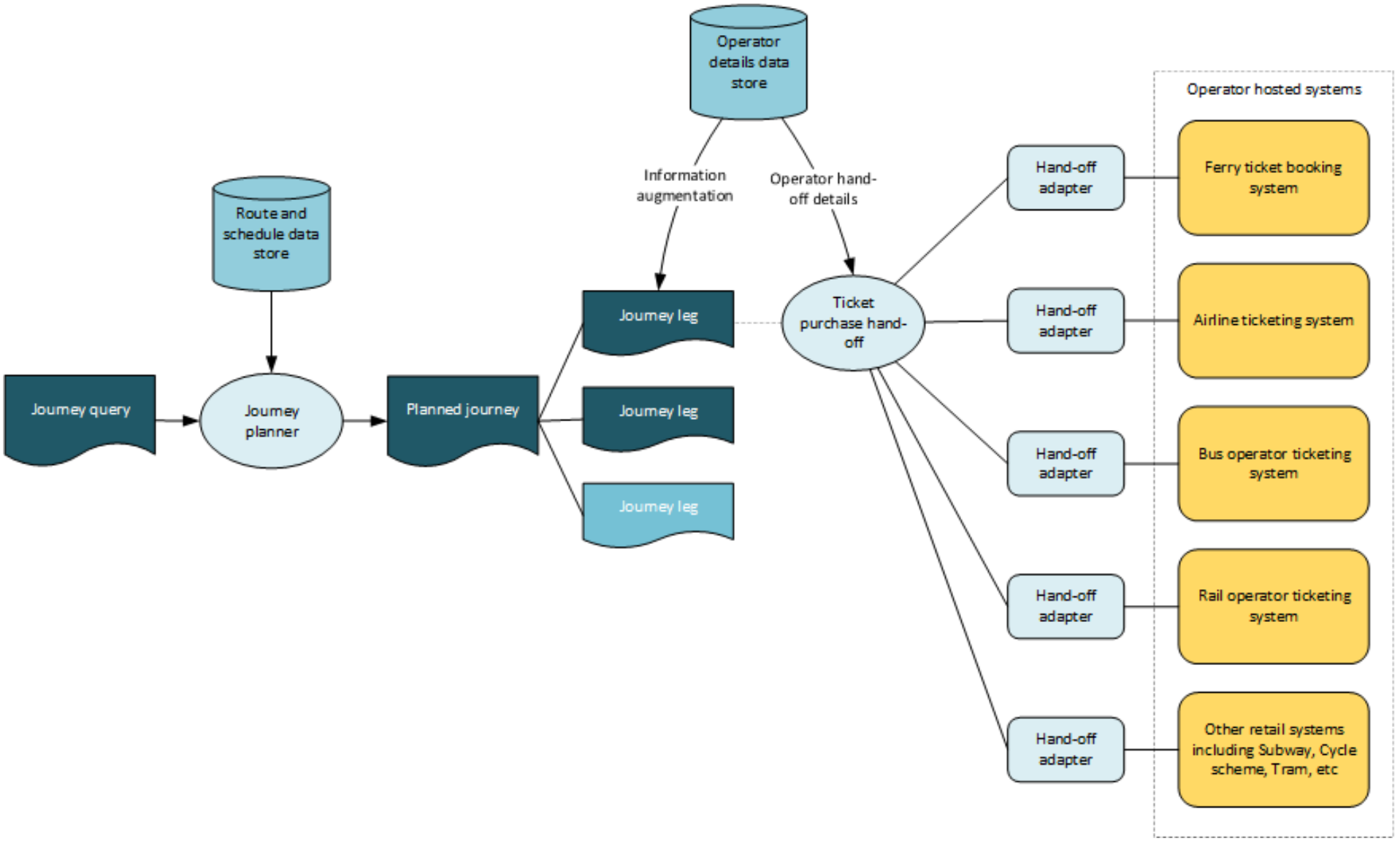
c) Consider providing additional support to smaller operators to address the willingness to participate in the Aggregator stage 2 recommendations – as identified in the Discovery assessment report, current support for 'deep linking' to operators' online sites are low. See section 14.1 for more details on operator participation willingness.

Both these solution options are illustrated in the following diagram which shows how a journey query is processed by the journey planner into a planned journey consisting of legs. Each leg can have static information overlaid based on operator and service. A button (or link) can be provided for purchase of a ticket which can hand-off to the operator website through a custom adapter. Please also see process flow diagrams in section 9.2.

Operator web retail platforms are considered to be the "operator assets" that need to be integrated to support retail hand-off. These are a combination of hosted and managed systems such as those provided by Trainline to ScotRail or custom web retail systems bespoke to an operator developed in-house or by 3rd party web design agencies. An assessment of operator web retail capabilities is contained in the Discovery assessment report.

Where operators wish to provide static information to supplement journey planning results, they will be able to do so using common format file exchange. Such information is not expected to change frequently so no system export support will be required for these files.

The hand-off approach will not be exposed to 3rd parties through the API. The complexities of adapting to the different retail websites are not intended to be exposed outside of Traveline Scotland. This would need to be a 3rd party to retailer direct relationship.



7. Stage 3 single end to end journey purchase: assessment of options and recommendations

An assessment of options and recommendations relating to the integrated fares and ticketing solution design for stage 3, is detailed in the following sections.

7.1 Stage 3 description

The options assessed will need to address the scope of stage 3 which is described below:

- Development of a full API integration between TLS and operators to support fares and ticketing to allow 3rd party online retail.

This description is looking for Traveline Scotland to manage a web commerce platform such that end to end journey comprising of multiple journey legs access multiple operators, can be purchased in a single transaction. Another way of looking at this is a basket containing multiple tickets, one for each leg that can be retailed online. Some legs might involve a bus journey where no advanced fare can be retailed. In this case, the customer would be expected to walk up and buy the ticket on vehicle.

7.2 Stage 3 options

Based on the Discovery requirements and assessment work, a single solution exists for Stage 3, as summarised in the table below:

Option name	Option description
TLS originated single purchase of tickets for end-to-end journey	TLS originated single ticket purchase, where TLS take payment for end-to-end ticket. TLS request fulfilment of journey legs onto participating operators. TLS perform subsequent reimbursement to operators. Provide APIs such that 3rd party application providers can make end-to-end ticket purchase.

There may be multiple API options that could be used to implement the above option however these would all be similar in core architecture.

7.3 Technical and business considerations

For stage 3, technical and business considerations have been described below.

7.3.1 Technical

There are several core concepts that will need to be addressed by the Traveline Scotland web site and mobile app that are not present currently. These include:

- Shopping basket conventions of adding products for purchase, removal from basket and check out processing.
- Recording the number of adults, children, concessions to make a trip. This will allow for multiple tickets to be purchased at the same time.
- Interfacing with a payment service provider to allow card payments to be accepted to settle basket of tickets.
- User account - the Traveline Scotland website has the concept of user accounts for registration to receive travel alerts. This functionality is limited but might be used to allow for customer preferences and purchase history to be recorded.
- User verification - in registering for a Traveline Scotland website account, email accounts should be validated. This allows subsequent email notifications regarding tickets and travel to be sent to a legitimate account.

The standard nature of the previous points mean that a new Commercial off the Shelf (COTS) ecommerce website might be architecturally better than adding these features onto the Traveline Scotland journey planner. Within the mobile app, having the whole experience “in app” would be the desired implementation.

Currently following a journey plan using Traveline Scotland website, a selected multi-mode journey is presented using a popup that can be scrolled up and down. Options are provided for copying the journey content or having it emailed to you. User interface/experience design would be required to make this information more impactful and to make it clear that there are purchase options available. On selection of purchase options, each leg could be added to a basket that could be adjusted for the number of travelling adults or children.

Some operators such as air and ferry will require additional information to be recorded such as name and address and contact information. Additional booking information like cabins, seat reservations (rail, air, ferry), food and entertainment will need to be considered.

The checkout processing will require payment options to be presented and payment taken in a PCI/DSS compliant manner. Purchases need committing for back office processing post purchase.

7.3.2 Business

Terms and conditions will need to be presented and accepted covering the following points:

- Traveline Scotland terms and conditions include permission to provide ticket details to participating operators.
- Statements on data sharing.
- Links to participating operators’ conditions of carriage.
- Position on consequential delay (see below).

There are back-office processes required to fulfil a ticket purchase. These are:

- Send email confirmation with order reference number, details of order including date of travel, receipt information and links to terms of carriage for each operator.
- Start the fulfilment of tickets. This will involve for each ticket leg:
    - Make request to registered operator API end-point providing transaction reference and details of ticket request.
    - Receive by return, an acknowledgement of acceptance and operator specific transaction reference number.
- Ticket revenue apportionment will be a background accounting process to accrue account balances for each participating operator. Settlement would be made against these account balances on an agreed schedule (weekly or monthly). This will involve bank transfer processes.
- Consideration should be given to platform fees for processing the transaction. This can be a supplement charged to the customer for the convenience or a charge deducted from the amount settled back to the operators.
- Consideration should be given to insurance to handle cases of consequential delay. Example is a delayed train journey then means that a scheduled flight or sailing is missed. The customer (and possibly family) are now stranded and are in need of alternative travel and accommodation. As used by the airlines (Worldwide by Easyjet), a compulsory insurance policy can be used to handle this situation.
- Processes will be required for ticket amendment and/or refund. These might be self-service using a sufficiently feature rich back office or might involve calling the TLS call centre.

When an operator receives a ticket fulfilment request, they will need to process it such that the customer can avail of this ticket. This may involve:

- Emailing a barcode for home print. This will work with many but not all bus operators and not ScotRail.
- Emailing of booking reference information for further redemption using operator sites and mobile apps.
- Generation of a ticket via action-list for fulfilment onto an existing ITSO card. Existing card ISRN would need to be captured as part of purchase information.
- Creation of new ITSO card with ticket pre-loaded or action-listed for future collection.

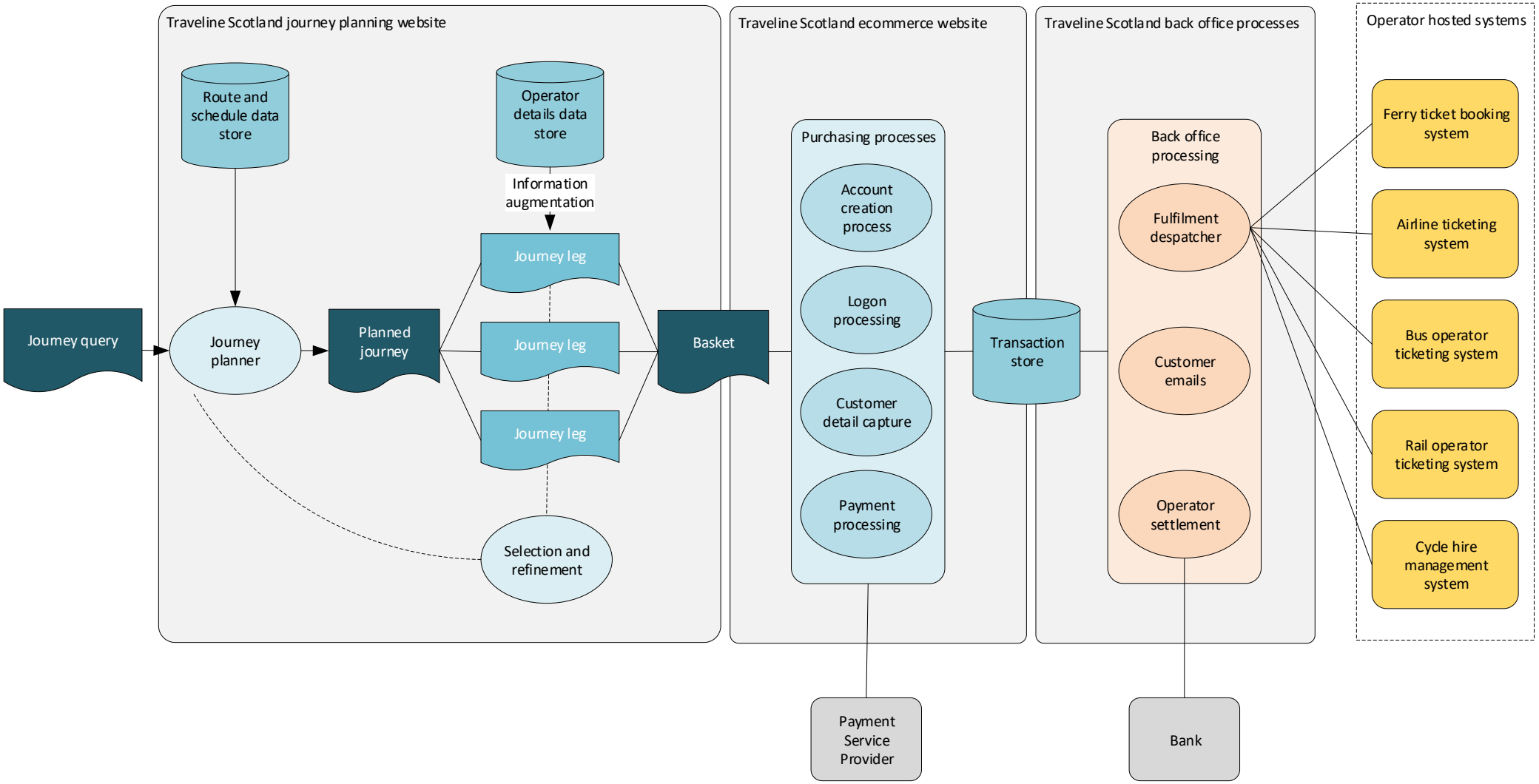
- Creation of ticket in an m-ticket platform and instructions sent to customer on how to register and collect their ticket.

A significant challenge with the concept of single purchase is that not all fares are available for purchase online. Most low value fares like those that might be used for first or last leg of end-to-end journey are not available for advanced purchase. A customer can just be advised that they need to purchase a ticket onboard and inform them of what payment methods are available. If PlusBus were to be more comprehensively support (as recommended in section 2.5), this would provide a valid advanced purchase option for first and last leg of a journey.

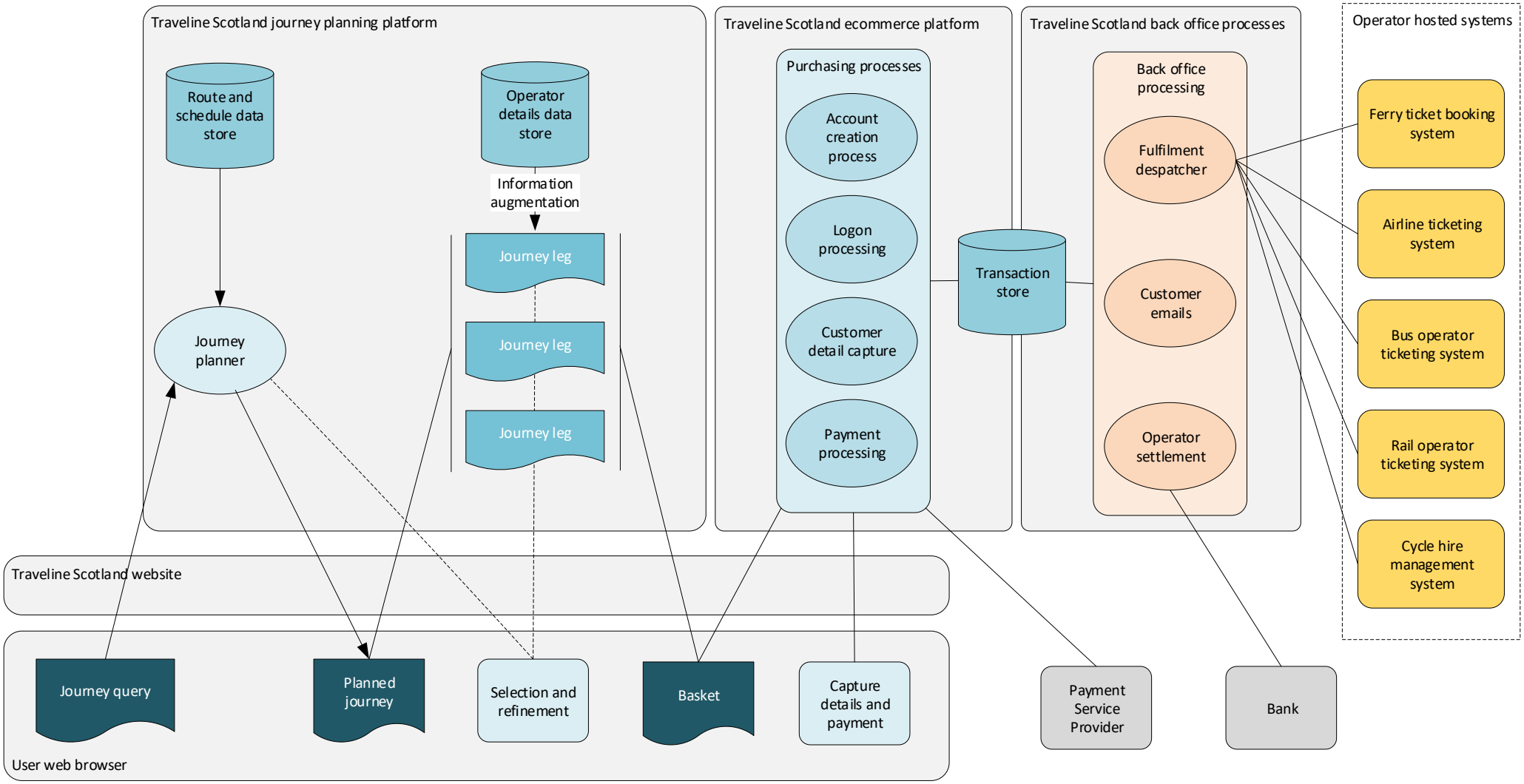
Traveline Scotland can provide an API that would request fulfilments following the journey planner providing a planned and priced set of results. In this case, the 3rd party would be responsible for taking payment and will have their own set of terms and conditions to accept. The API would record the purchase of tickets where available (for online purchase). The 3rd party would be invoiced for sales revenue less negotiated commission. There would be risks associated with 3rd party payment that would need to be managed.

The points discussed in the previous section can be illustrated as follows:

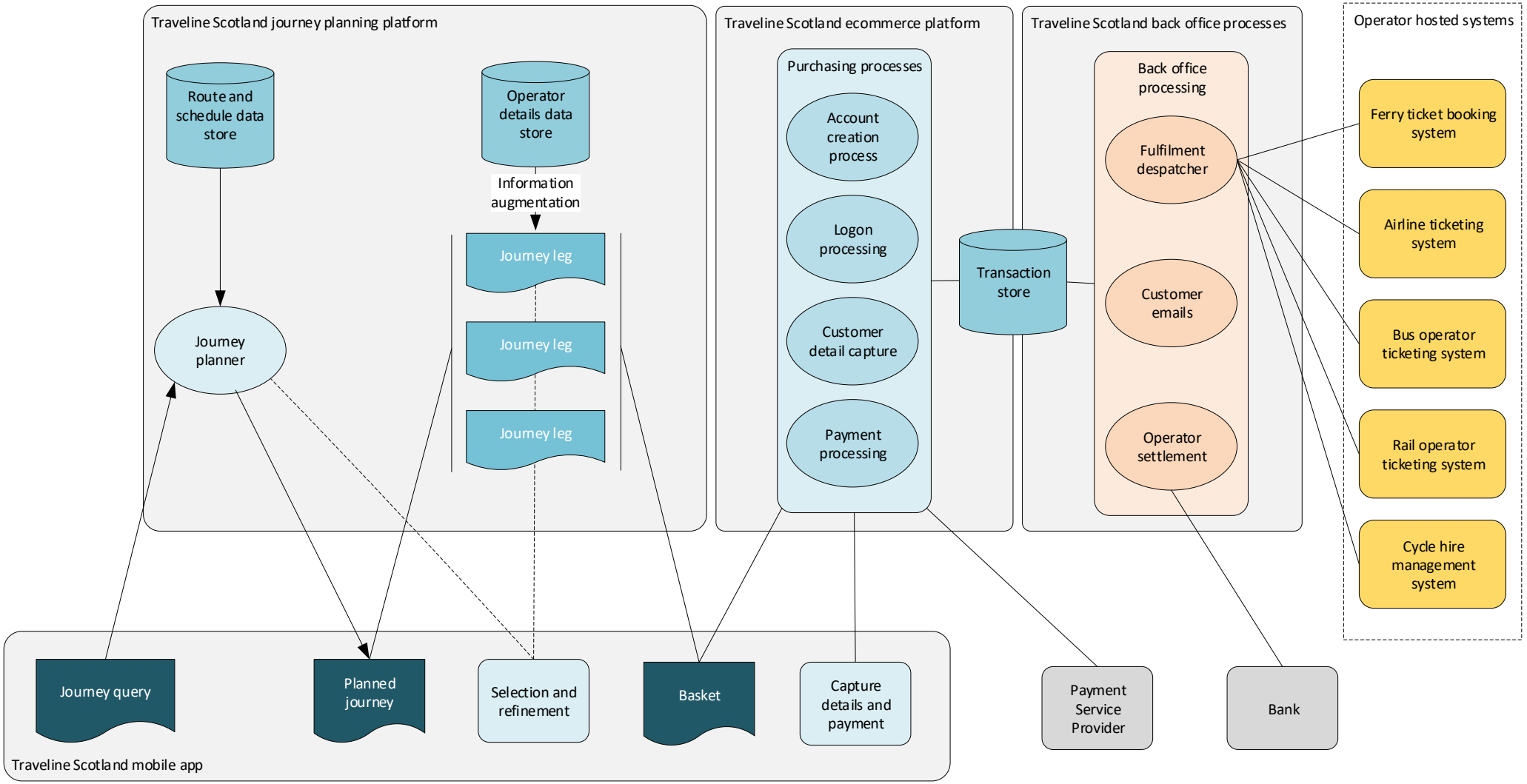
The following diagram shows the separation of journey planning, ecommerce and back office processes to take a journey query into a basket to be fulfilled. The reader is referred to the process flow diagrams in section 9.3 which document the stages carried out by each actor.



This concept is split further to show the user interface elements that would take place in a customer web browser. This allows the central core functions to be made platform services and accessed through APIs.



This model then adapts nicely to a mobile app version of the solution reusing the same platform APIs and back office processing that the web site uses.



7.4 Retail API to operator websites

A list of operators' back office systems which will require APIs to be established for the stage 3 single purchase option 1 are detailed below. This has been based on the operators which participated in the discovery assessment.

Transport mode	Operator back office system providers
Bus	Variety of in-house systems Nevis McCain ACT Rezdy Other bus operator systems not captured in assessment
Tram	In-house
Subway	Nevis
Ferry	Hogia Bookit In-house Other ferry operator systems not captured in assessment
Rail	Trainline provided platform for ScotRail
Air	Airline systems not captured in assessment
Cycle	In-house systems

7.5 Use case alignment

As assessment of how each solution option, aligns with the use cases, is detailed below, which have been scored using None 0, Low 1, Medium 2, High 3.

Customer use case	Option 1 (single purchase)
Local city commuter	1
Inter-city commuter	2
Business traveller to Scotland	2
City off peak day leisure/retail visit	1
Domestic tourist walking trip	2
Foreign tourist	2
Hospital visit	1
Traveller with no detailed knowledge of public transport	2
Low income commuter with disrupted journey	1
Student in further and higher education	3
Rural traveller	2
Islands resident regular traveller	2
Totals:	**21**

Option 1, TLS originated single purchasing of tickets supports scenarios where online tickets can be purchased such as for longer journeys and local journey weekly bus tickets. However, where online tickets are generally not retailed such as for single bus tickets, the alignment to the use cases is weaker.

7.6 System development effort

A high-level assessment has been made of the system development effort, for TLS and third parties implementing the solution.

Option	Task	Effort
Single purchase	Improve presentation of purchase options following planned journey on Traveline Scotland website. Aspects such as sorting by price or travel time are to be considered. This task is expected to include some UX/UI work on presentation. Work is expected to cover both web site and mobile app development.	Moderate
	Development of customer registration for user accounts and checkout facilities including payment service provider integration.	High
	Development of back office processes to fulfil a single ticket purchase through its component parts through multiple operators.	High
	Development of back office processes for revenue settlement back to operators.	Moderate
	For each participating operator (x n), development of back office functionality to allow the fulfilment of tickets	High x n

The option listed above presents a significant investment in development, system extension, or procurement and implementation.

7.7 Benefits

For the stage 3 option, anticipated benefits are listed and scored below using scoring as None 0, Low 1, Medium 2, High 3.

Benefits category	Benefit	Single purchase of tickets for end to end journey
Fares data	Consistent bus fares data standards and operability	0
	Complete upload of bus operator fares data for TLS Data Management	0
	More efficient TLS fares data management	0
	Complete fares data across transport operators and modes	0
Customer experience	Increased provision of online ticketing and fares info	3
	'One stop shop' for ticket purchasing across transport operators and modes	3
	Easy, standardised and cashless customer experience	2
	Customers can purchase 'there and then' on app	0
	Increased smart integrated ticketing take up across all transport modes	2
	Increased journey planning information for cycle schemes and DRT	0
	Improved first and last leg multi-modal journey planning	0
Operator benefits	Greater pre-payment for integrated ticketing	3
	Modal shift from car to cycle schemes	0
	Greater customer marketing opportunities	3
	Revenue switch to public transport for new and occasional customers	2
	Rail smart ticketing obligations	2
	Less operator effort and cost in handling cash	3
	More efficient and automated operations	3
	Quicker bus boarding times	2
	Reduced bus operator dwell time costs	2
	Decreased operator costs through better prepared customers	1
Totals:		**31**

The option will contribute benefits for both customers and operators.

7.8 Alignment to strategy

The proposed solution should align to the overall Scottish Ministerial vision to support customer-focused, multi-modal, multi-operator smart ticketing system across Scotland.

In addition, the Aggregator solution should align to the Transport Scotland 'Smart ticketing & payments delivery strategy'. An assessment of the proposed Aggregator solution options against the delivery strategy goals is detailed in the table below.

The goals have been scored using None 0, Low 1, Medium 2, High 3.

Strategic goal	Single purchase of tickets for end to end journey
That all journeys on Scotland's bus, rail, ferry, subway and tram networks can be made using some form of smart ticketing or payment	2
Increase the smart ticketing and payment offering and take up across all transport modes	2
Increase smart ticketing interoperability across operators and modes	1
Encourage a higher level of consistency in the smart ticketing customer proposition for members of the public	1
Improve the provision of online ticketing and fares information along with the range of smart retail and payment options	3
Simplify and improve access to the right price for customers through improved information and ticketing options	3
Increase the number of operator/local authority/regional transport partnership smart ticketing or payment schemes implemented, to meet local needs	1
Ensure successful continuation of concessionary travel as an ITSO smart interoperable scheme	0
Facilitate wide as possible use of a standardised platform for all public transport providers, with the purpose of bringing true interoperability	3
Totals:	**16**

As might be expected, Stage 3 provides a much greater alignment to the Transport Scotland strategy than the previous stages although it should be noted that Stage 1 is a dependency of Stage 3.

7.9 Risk assessment

An assessment of risks together with mitigating actions relating to stage 3 options is detailed below. NB all risks identified in stage 2 also apply to stage 3.

The risks have been identified, based on discussions with suppliers and operators during the assessment and recommendations stages. The risks relate to the achievement of the desired benefits for the recommended options for each of the 3 stages in this report.

Risk category	Risk	Risk description	Impact/ Probability	Risk mitigation
Operational	Not all single trip tickets can be bought online.	In an end-to-end journey, a single bus trip might be required at either end. Operators do not allow online purchase of such simple tickets, preferring to retail the weekly (or greater) season tickets online.	High/ High	Operators to make provision for purchase through APIs of ticket types not generally available for online retail, but this is unlikely to include single fares. Alternatively, inform customers that these legs of journeys need to be paid for as they are used and what payment methods are supported.
Operational	Complexity of back office functions.	Back office functions, to manage retail payments and travel ticketing across transport modes and operators may be complex.	High/ High	There are many reference cases relating to online shopping that can be used to mitigate this risk. It is a well-known risk.
Operational	Consequential delay.	A delay of one travel leg of a journey may result in a following travel leg being missed and travel tickets subsequently becoming invalid.	Medium/ Medium	Potentially insurance will be required for handling of consequential delay. This is offered in some airline booking systems where multiple operators are involved. A suitable insurance provider would need to be identified and contracted with. They may need access to back office systems to manage consequential delay.
Operational	Refunds and amendments.	Customers may find refunds and amendments challenging. Customers will need an easy process to manage refunds and ticket changes across journey legs.	Medium/ Medium	A level of customer self-service would be anticipated using the user account with Traveline Scotland. Customer support function required for refund and amendments process in such a way that TLS will not be liable for consequential loss. The

Risk category	Risk	Risk description	Impact/ Probability	Risk mitigation
				provider of this service would need access to back office systems to manage changes.
Technical	Operator system support for 3rd party fulfilment requests.	Most operator back office systems currently do not support 3rd party fulfilment requests.	Medium/ High	Enhanced data overlays provided by previous stages would be presented if 3rd party fulfilment is not possible with an operator. Provide funding and support to operators for back office system enhancements.
Operational	Commercials, reimbursement and settlement processes.	Commercials may disadvantage operators. Operators will need to get a fair reimbursement for parts of the multi-leg customer journey.	Medium/ Medium	Commercials and T&Cs need to be agreed for Aggregator solution. Revenue reimbursement model and processes needed that does not involve the operator effectively discounting their tickets.
Operational	Smart ITSO and Mobile – different operator agendas	Some operators have a smart / ITSO agenda whereas other operators have clear mobile agenda. Some m-ticket solutions may not allow retail from TLS site.	Medium/ Medium	Use of ticket media (smart vs m-ticket) to be operator preference.
Customer adoption	Fares API made available to 3rd parties	Customer may not see the enhanced TLS journey planner capabilities if they use 3rd party journey planners.	Medium/ Medium	To maximise the desired benefits of the Aggregator vision, making the fares data API available to 3rd parties may be beneficial. TLS API provision, commercial agreements and rate limits would need agreement.
Technical	Additional ticket sale items	Operators such as ferries, offer additional sale items e.g. cabins, which must be offered in solution, otherwise customers may not use the TLS solution.	Medium/ Medium	The TLS solution must feature purchase options for additional sale items.
Technical	Future proofing	The proposed solution may be overtaken by market developments.	High/ Medium	The proposed solution should be future proofed for market developments.

Risk category	Risk	Risk description	Impact/ Probability	Risk mitigation
				The solution recommendations to take account of market developments, specifically around integration of MaaS solutions. This would allow other service providers with user account and registered payment method to purchase tickets through TLS.

7.10 Account Based Ticketing context

Transport Scotland requested that the Discovery project should have due regard for Account Based Ticketing (ABT) in the conclusions of this report as context, but not be directly assessed as a stage 3 option.

ABT enables a "pay for where you travel" model with the possibility of best value and fare cap guarantee for walk-up fares, enhanced with ticket offsetting (such as against season ticket purchases) and virtual tickets. A common operator acceptance required of travel token(s) will be required. ABT can work inter-city but requires wider supporting infrastructure for common acceptance of tokens.

ABT has been widely accepted as successful in London with the system providing best value fares based on travel. There are also reports that once you remove the conscious payment from travel, customers travel more which ultimately means more revenue. ABT has not been adopted in the Scottish transport industry to date but is currently being trialled by ScotRail.

The ABT approach to end-to-end travel, enables the following aspects of the single ticket purchase model to be avoided:

- Taking payment in advance of travel.
- Fulfilment of tickets using operator systems.
- Customer support in case of amendment or refund.
- Insurance concerns over consequential delay.

However, ABT solutions still have the following challenges:

- Inter-city concepts are in their infancy.
- Groups / families are not well supported in models presently.
- There is no common token acceptance model in place.
- Contactless bank card is seen as the typical token but this is not the only possibility.

7.11 Recommendation

Considering the effort, complexity and therefore cost associated with implementation of the single purchase concept, it is our recommendation that stages 1 and 2 are implemented and proven prior to progression of stage 3.

Consideration should also be given to providing additional support to smaller operators to address the willingness to participate (see section 14.1 for participation details) in the single purchase solution – as identified in the Discovery assessment report, current support for 3rd party operator ticket sales is currently low. Bus operators expressed varying levels of challenge to enable 3rd party ticket retail.

Stage 3 should again be compared to latest ABT developments in the industry and ongoing trends to ensure that the correct goals are being targeted. ABT may also provide a strategic direction towards MaaS and alignment with developments in the rest of the UK and Europe. ABT better supports scenarios where regular use of medium distance and local transport is required, where the customer can easily 'tap in/out' of different transport modes and operators. The specification and implementation of a national ABT system is outside the scope of this discovery engagement. It is a complex system that would need significant procurement investment for a national implementation.

The business case for Stage 3 will need careful exploration to ensure value is understood and that benefits and usage, have been realised from Stages 1 and 2.

Operator web retail platforms are considered to be the "operator assets" that need to be integrated to support Stage 3 recommendations. Such platforms will need to provide APIs allowing a purchase to be requested by an external system as if it has been purchased via a web browser. As assessment of operator web retail capabilities is contained in the discovery assessment report.

8. Assumptions and constraints

Identified assumptions and constraints in agreeing solution recommendations are detailed in the following sections.

8.1 Assumptions

Assumption	Assumption description
Transport (Scotland) Act	When implemented, the act will require operators to publicise fares information that will be required for the Stage 1 solution.
External funding	External funding and support are likely to be required for small operator process and technology improvements effort.
TLS marketing	Marketing needed to publicise the TLS journey planning enhanced capabilities on companion sites such as Visit Scotland, Scotland.org, etc.

8.2 Constraints

Constraint	Constraint description
Data standards	The stage 1 solution recommendations are constrained by the timescales for industry adoption of the DfT sponsored NeTEx initiative for fares data standards. The stage 1 recommended solution has included some interim process and fares standards improvements until the NeTEx standard is adopted by the industry.
Simple fares that might be used in an end-to-end journey plan are often not available for online purchase	This has also been listed as a risk as where a journey plan involves one or more legs using a bus service, it might not be possible to purchase a ticket for these legs as there is no single fares available for purchase online. This would negate the aspiration of single ticket purchase. E.g. Bus->Rail->Bus would turn into just a Rail ticket with instructions to buy bus ticket onboard using contactless bank card.
Cycle share scheme integration	Cycle share schemes involve asset provision rather than service provision in that an asset “bike” is taken away for a period. To support this the scheme needs to have performed a level of user registration checks and have a payment method registered. Cycle schemes do not provide a reservation system, but schemes provide real-time availability information. This means that cycle share schemes can be represented in a journey planning system, but usage cannot be booked or pre-purchased. Augmenting journey planning results with prominent cycle share scheme information where bikes are a sensible choice for a journey leg.

9. Process flows outlining the data management processes

'To be' process flows outlining the processes for each of the recommended solution stages 1 –3 are detailed in the following sections.

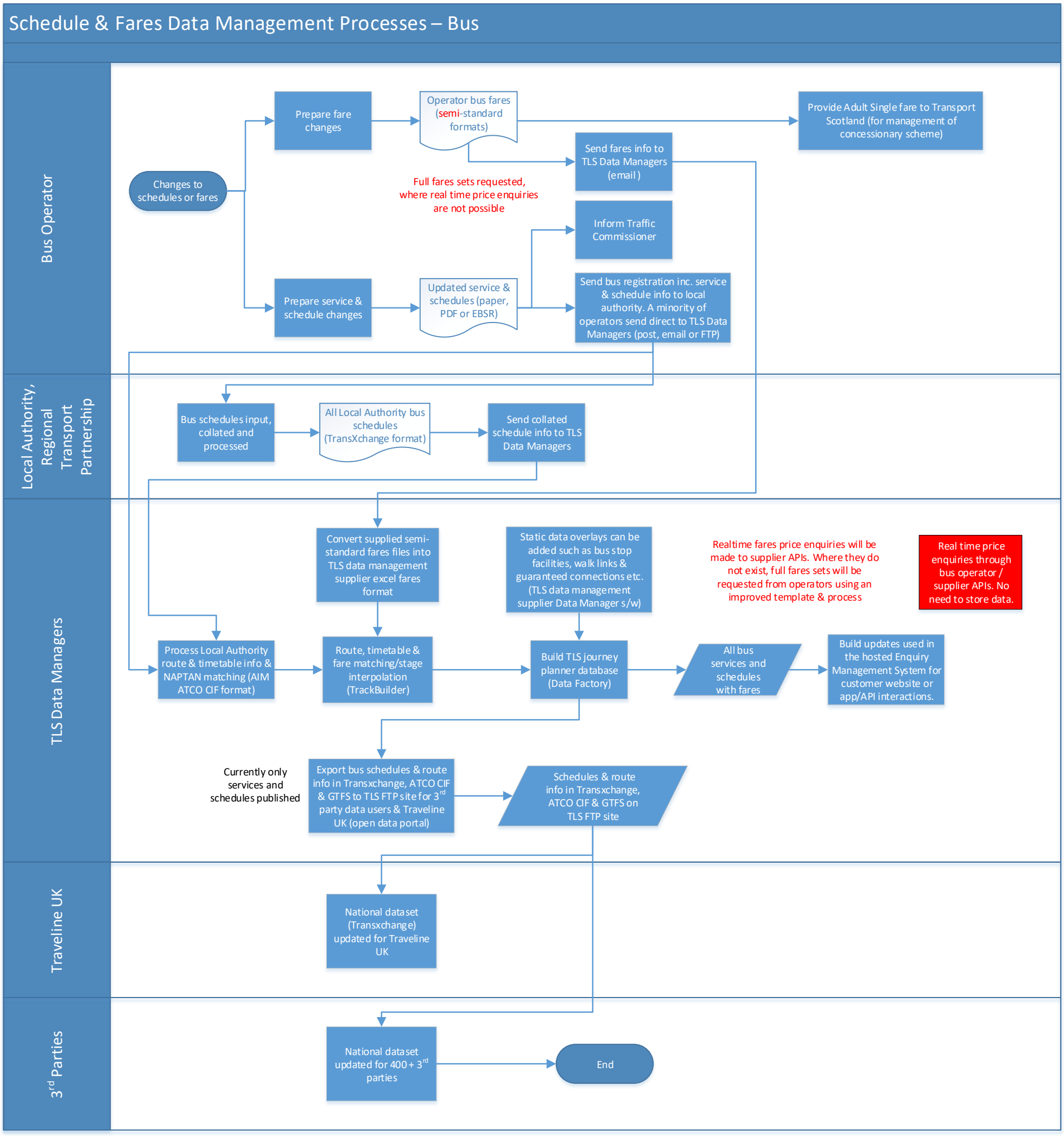
9.1 Stage 1 – Enhancement of TLS fares datasets

Data management processes for the collation and updating of fares information from the discovery assessment report, have been updated to reflect the Stage 1 recommendations for bus, ferry and air, with changes shown in red.

The processes for Tram and Subway remain the same, due to simple standard price fares structure. The processes for rail remain the same except that all fares, including advance tickets, will need to be processed in real-time from the RDG feeds. These processes have been documented in the Discovery assessment report and have not been repeated in this report.

9.1.1 Bus

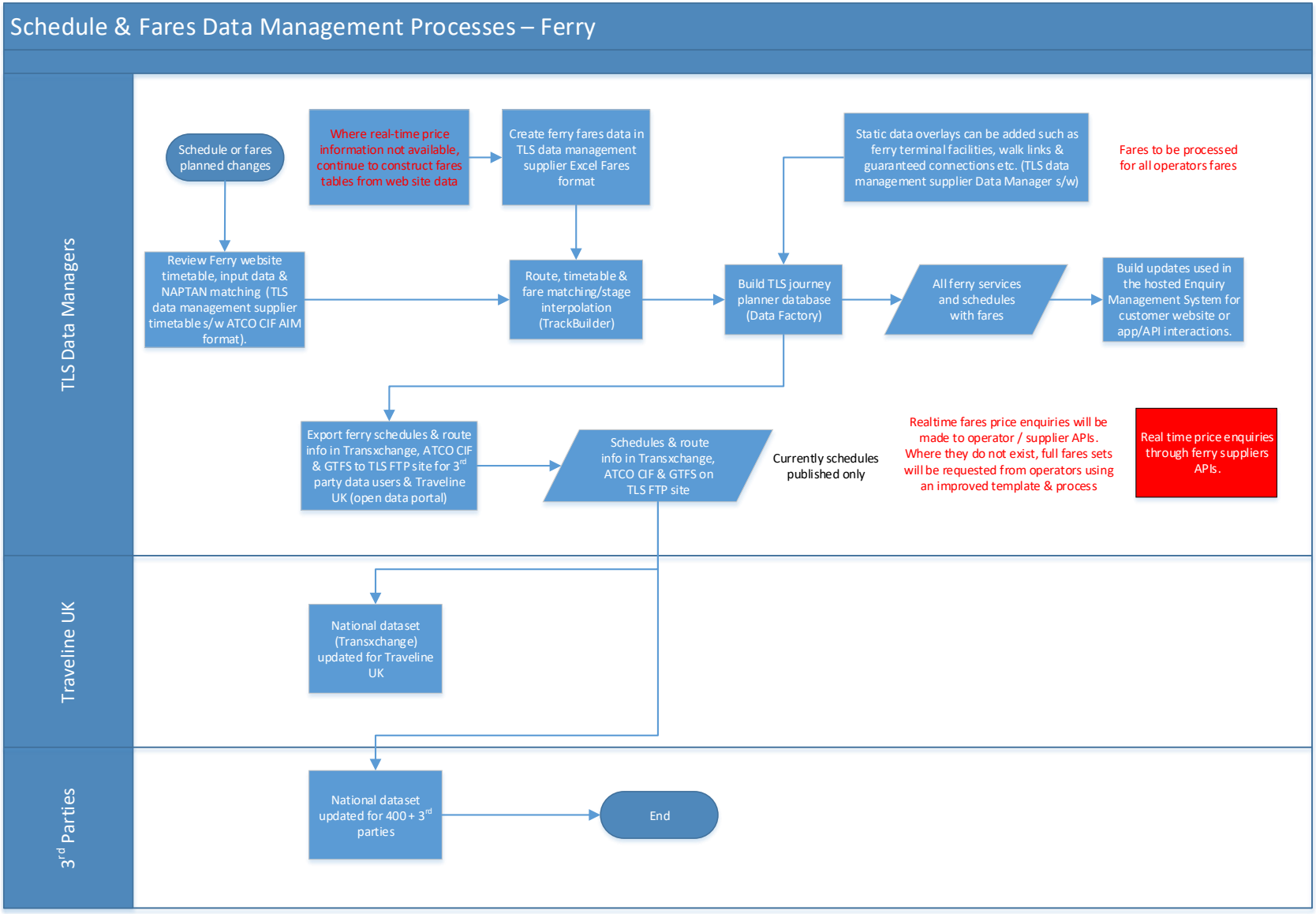
The 'to be' bus process flow, with changes shown in red, together with description of the process steps which have changed, is detailed below.



Process task	Process task description	Responsibility
Prepare fare changes	When fare changes are planned, the operator prepares fare changes, in an improved semi-standardised template format (until NeTEx is adopted through the transport industry). This is primarily used when operators are unable to support real time price enquiries (below).	Operators
Send fares info to TLS Data Managers	The operator submits the fares information using a new sFTP site, which should be maintained by TLS for data submission from the operators, for the TLS data processing.	Operators
Real time price enquiries through bus suppliers' APIs	Realtime fares price enquiries will be made to operator/ supplier APIs.	Fare allocation process
Convert fares files into TLS data management supplier excel fares format	Where real-time price enquiries are not possible, the operator fares will be accessed from the new sFTP site and converted into standard Excel format for import into the TLS Data Management supplier software.	TLS Data Managers

9.1.2 Ferry

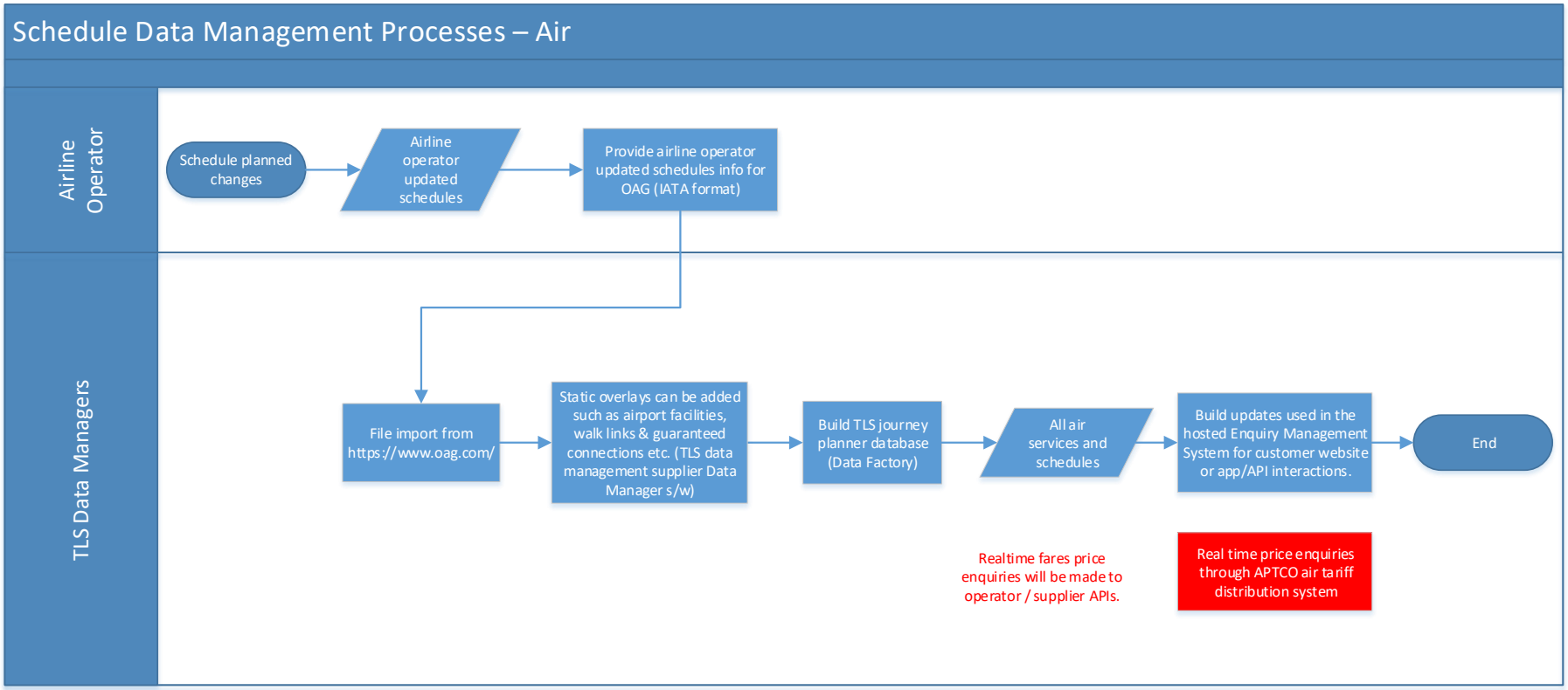
The ‘to be’ ferry process flow, with changes shown in red, together with description of the process steps which have changed, is detailed below:



Process task	Process task description	Responsibility
Where real-time price information not available, continue to construct fares tables from web site data	Ferry operators not providing real-time information would be requested to complete files detailing their fare structures. It is anticipated that a fall-back of constructing these files from website data will be required. The TLS Data Managers review any ferry fares changes on the ferry operator website and update ferry fares data in the TLS Data Management supplier Excel fares format as required.	TLS Data Manager
Real time price enquiries through ferry suppliers' APIs.	Realtime fares price enquiries will be made to supplier APIs where this is possible.	Fare allocation process

9.1.3 Air

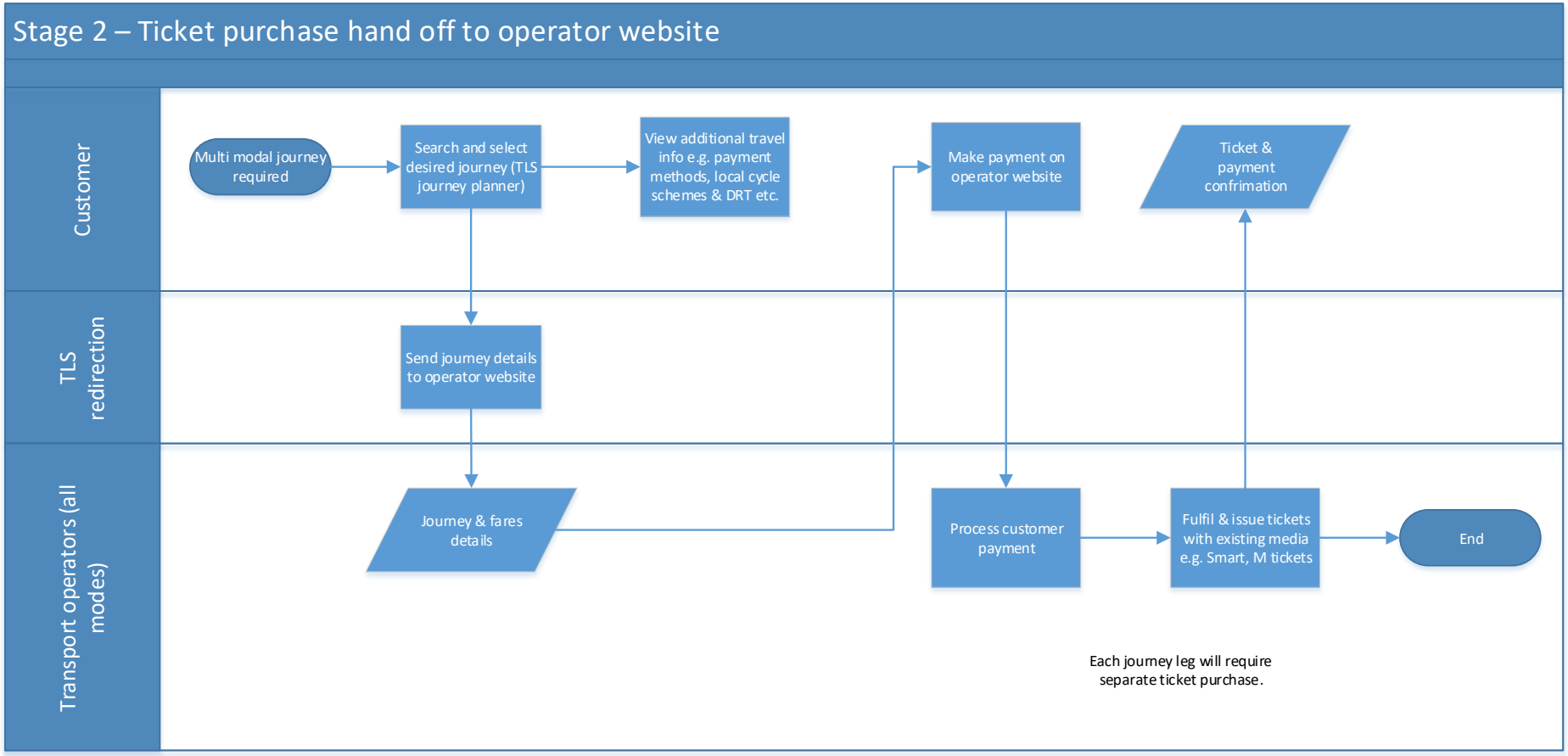
The ‘to be’ air process flow, with changes shown in red, together with description of the process steps which have changed, is detailed below.



Process task	Process task description	Responsibility
Real time price enquiries through APTCO air tariff distribution system	Real time price enquiries will be made through the APTCO air tariff distribution system	Fare allocation process

9.2 Stage 2 – API Lite integration for ticket purchase hand-off to operator web site.

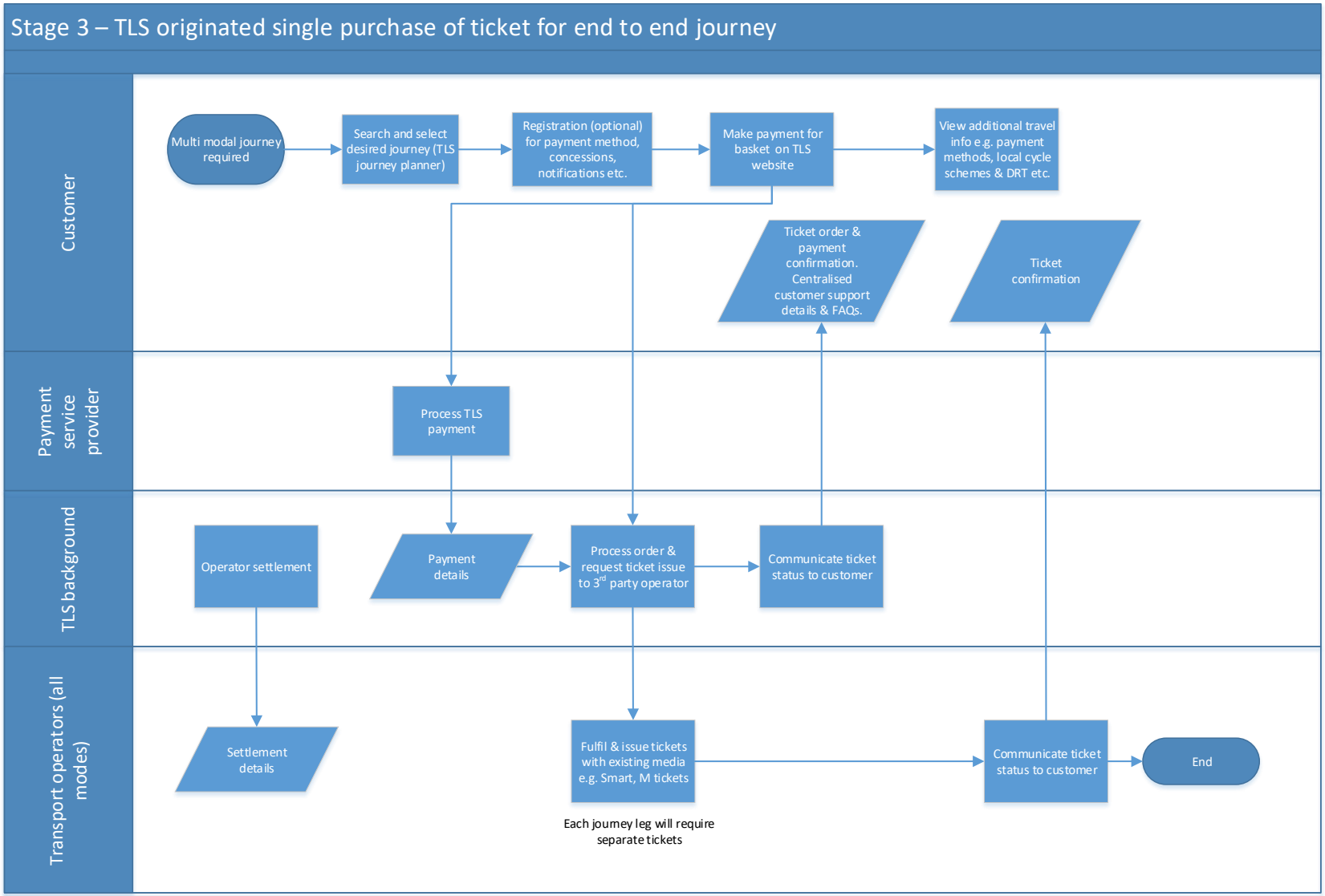
A recommended process for the stage 2 ticket purchase hand offs, together with a description are detailed below. As before, associated implementation tasks for this process will be shown in the subsequent outline project plan deliverable.



Process task	Process task description	Responsibility
Search and select desired journey (TLS journey planner)	The customer will search and select their desired journey using the TLS journey planner. The customer selects a 'buy now' icon.	Customer
View additional travel info e.g. payment methods, local cycle schemes & DRT etc.	There are levels of information that can be overlaid against the operator and the specific service being operated. Where an operator has no online retail capability, the customer can view additional travel info as static overlays on TLS journey planner, such as on what payment options are available on bus e.g. cEMV, cash (no change), etc.	Customer
Send journey & fares details to operator website	The TLS website will automatically send the customer journey & fares details to the operator website which the customer will be re-directed to.	TLS background
Make payment on operator website	The customer will be prompted to make the payment on the operator website and complete the payment.	Customer
Process customer payment	The operator will process the customer payment.	Operator
Fulfil & issue tickets with existing media e.g. Smart, M tickets	The operator will fulfil & issue tickets with existing ticket media options e.g. Smart, M ticket. A payment communication will be sent from the operator. Each journey leg will require a separate ticket purchase from the relevant operator.	Operator

9.3 Stage 3 - Full API integration between TLS and operators to support single ticket purchase

A recommended process for the stage 3 Traveline Scotland originated single purchase of tickets option, together with a description are detailed below. As before, associated implementation tasks for this process will be shown in the subsequent outline project plan deliverable.



Process task	Process task description	Responsibility
Search and select desired journey (TLS journey planner)	The customer will search and select their desired journey legs to add to a basket using the TLS journey planner. The fares for each leg and overall cost will be displayed. Each leg could be adjusted in the basket as the number of travelling adults or children is adjusted. For some modes and operators such as air and ferry, the customer may be required to enter additional information such as name and address and contact information.	Customer
Registration for payment method, concessions, notifications etc.	The customer has the option to register for an account, to indicate preferred payment method, record concessions eligibility, specify notification preferences, view purchase history, etc.	Customer
Make payment on basket on TLS website	The customer will make a single payment on the TLS website basket of journey legs using a preferred payment method. The customer will indicate a preferred ticket media where possible such as providing an ITSO card ISRN.	Customer
View additional travel info e.g. payment methods, local cycle schemes & DRT etc.	The customer can view additional travel information associated with the selected journey option. This may include: • local transport mode facilities • walking times to guarantee connections • transport mode payment methods • guidance on first and last leg of journey options such as cycle schemes and DRT options.	Customer
Process TLS payment	A payment service provider will process the customer payment from the TLS website. Separate processes will settle this revenue with the relevant operators.	Payment service provider
Process order & request ticket issue to	The TLS website background operations will process the customer order and request tickets to be issued from the operator to the customer for each journey leg.	TLS background

Process task	Process task description	Responsibility
3rd party operator		
Communicate ticket status to customer	A ticket order and payment communication will be sent by the TLS background operations to the customer for the journey basket order. This will include the order reference number, details of order including date of travel, receipt information and links to terms of carriage for each operator. Customer service contact details will also be communicated, for customer queries such as ticket amendments.	TLS background
Fulfil & issue tickets with existing media e.g. Smart, M tickets	The operator will receive the ticket fulfilment request, fulfil and issue tickets with existing ticket media options e.g. Smart, M ticket as per customer's preferred ticketing media. Depending on the operators involved, additional ticket options may be available such as print at home bar codes or new smart cards. Each journey leg will require a separate ticket to be issued from the relevant operator.	Operator
Communicate ticket status to customer	A ticket issue communication will be sent from each operator to the customer for each journey leg.	Operator
Operator settlement	Operator accounts will be maintained with portions of revenue based on tickets purchased. On a daily or weekly schedule, this process will credit operator bank accounts with revenue apportioned to them. A statement detailing the makeup of this amount will be provided to operator.	TLS background

10. Reporting dashboard

This section will outline a reporting dashboard that might be used to monitor the take up and effectiveness of the various stages of implementation proposed in this recommendations report. The purpose of such dashboard information will be to quantify the information being requested and measure follow on redirections or purchases. The exact presentation will change with implementation however this can be used as high-level requirements. Additional filters and variable reporting date bands can be implemented.

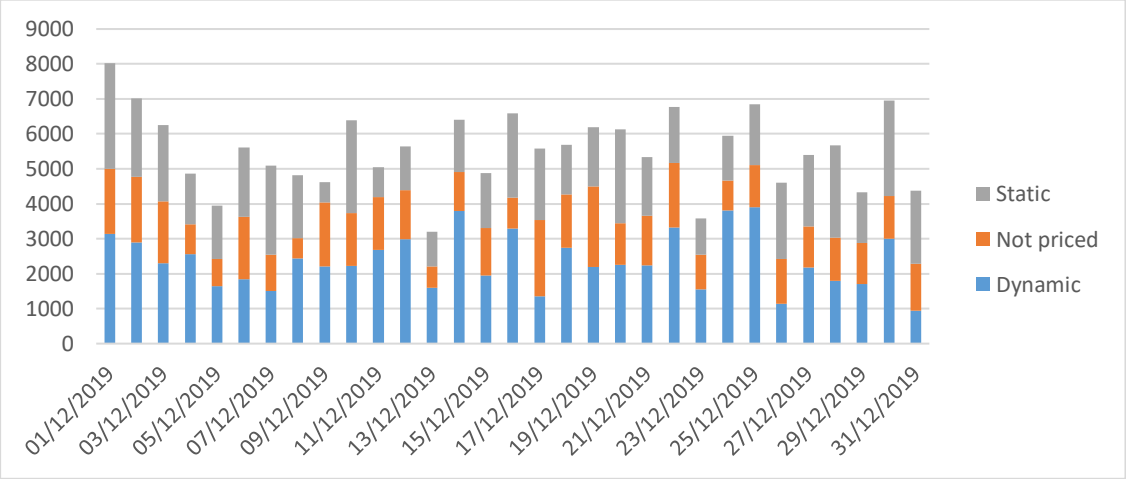
The following samples have been mocked in Excel using random data and provide no relationship to any query statistics that might be being achieved presently. Split by client mode are also entirely fictitious.

10.1 Stage 1 fares information enhancement

This stage concentrates on providing a more comprehensive set of pricing information in response to user queries. There is an expectation in this dashboard that query results can be categorised by client access e.g. web browser, call centre, mobile app.

Dashboard chart purpose and description

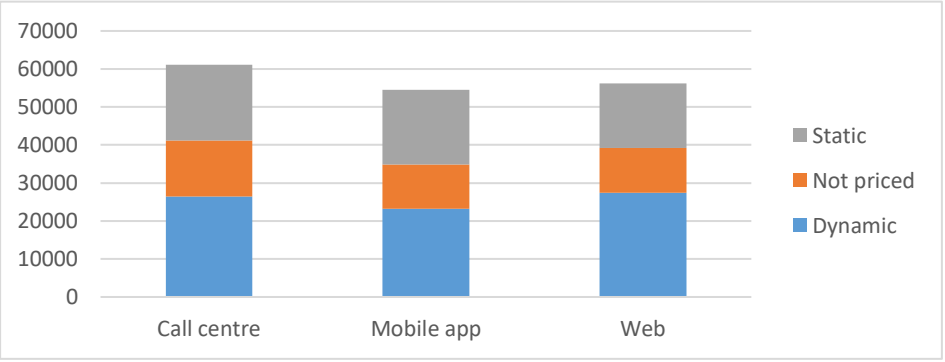
Trend observation over time period



The chart shows number of planned journey legs per day for previous month categorised by pricing information provided. This shows the number that were priced using a dynamic real-time query, a static fare data set or no pricing information.

Success would be a trend of steady increase of overall queries and a decreasing number of queries that have not been priced. It is anticipated that static queries will not be eliminated but an increasing number will be dynamic.

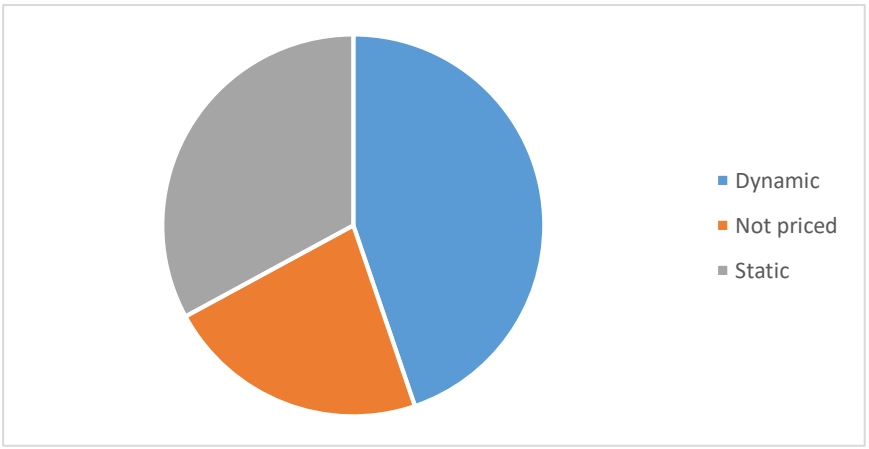
Pricing results by client – could be extended to classify 3rd party API users



The chart shows split of pricing results by client e.g. Web browser, Call centre or Mobile app. Results shown over month period to smooth out daily variances.

Success would be the same as for the trend chart above with resultion of not priced and increases overall.

Pricing results by type of query



The chart shows breakdown of results based on whether they are dynamically queried, statically looked up or no pricing information available. Results shown over a month period to smooth out daily variances.

Success would be the same as for the trend chart above with resultion of not priced and increases in dynamically priced.

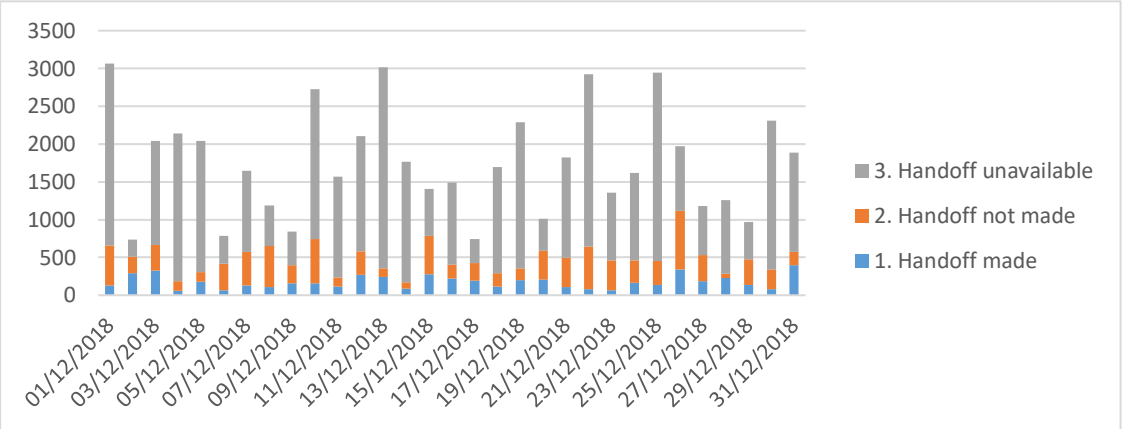
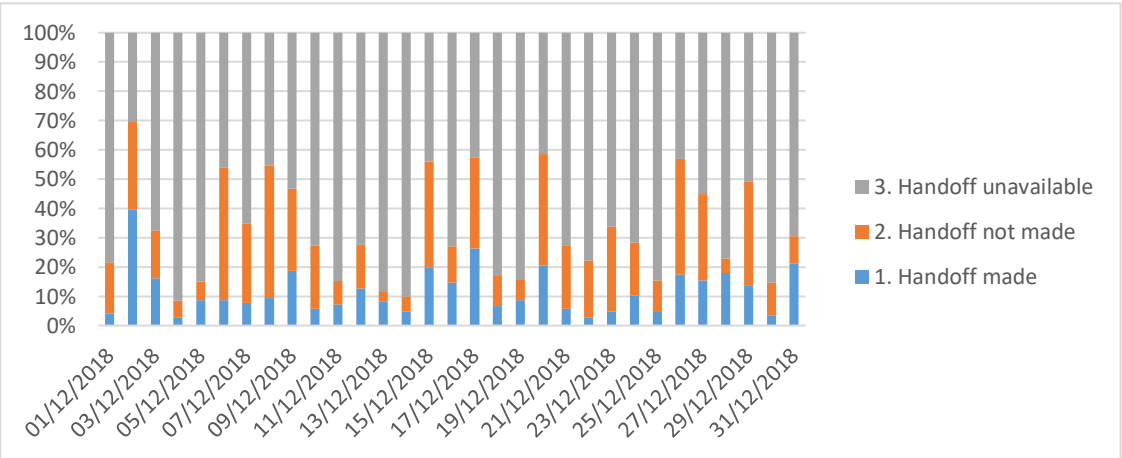
Further thoughts

Operational information can be captured to provide telemetry on the time taken to obtain pricing results by operator. This would highlight where caching might be necessary or that operator infrastructure is not suitable for the amount of queries bring made.

10.2 Stage 2 retail hand off

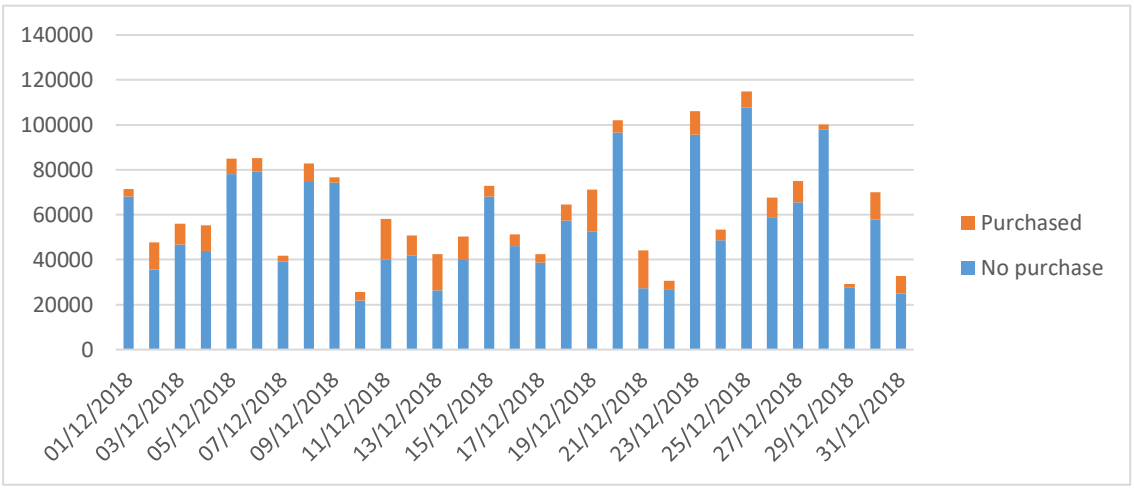
This stage looks at providing a facility for handing off retail sales to operator websites for purchase and / or more information. In addition, enhanced static overlay information on payment options can be provided.

It will be possible to register each operator handoff as a metric such that the number of click throughs can be measured and reported in the dashboard. It would not be possible to measure what static overlay information has been read and whether this influences a decision to travel or not.

Dashboard chart purpose and description
Trend observation over time period

The chart shows the split of all journey plans for a day split by whether handoff is available and whether it has been used (click to buy ticket). Success would look like an increasing number of handoffs available and and increasing number of handoffs being made. The same data is shown as a 100% stacked chart which takes absolute values of the of the analysis and provides raw percentages.

As per the Stage 1 charts this information could also be split by client Web browser, Call centre or Mobile app. Analysis could be performed though not necessarily for a dashboard into whether availability of dynamic pricing encourages the use of the hand off facility.

10.3 Stage 3 single end to end journey purchase

This stage provides facilities for single purchase of tickets for end-to-end journey. This is the first time that Traveline Scotland will have visibility of actual purchases and their value.

Dashboard chart purpose and description
Trend observation over time period

The chart shows the value of planned journeys and the value of those purchased through the Traveline platform. This could include purchase through client Web browser, Call centre or Mobile app. A version of this chart are envisaged that split these out by client.

11. Customer proposition

An outline of the customer proposition for journey planning, purchase and travel purposes is detailed below.

The development of the customer proposition has been based on the recommended Aggregator options and their alignment to the use cases and benefits as identified in the Discovery assessment engagement with operators.

The customer proposition will assist in formulating content for marketing campaigns to encourage use of the enhanced Traveline Scotland journey planner capabilities.

The customer proposition below covers the scope of all 3 stages.

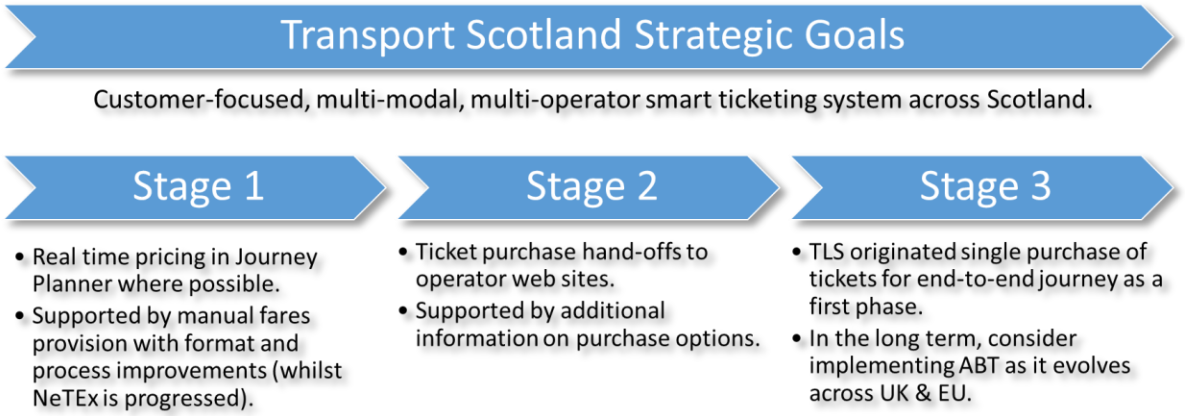
Journey planning	Registration	Purchase	Travel	Post journey
Journey planning across all modes with fares I can plan my whole end to end journey, quickest journey or lowest cost and compare the value. Real time information is shown for rail, air, ferry and many bus operators to get the best fare options.	**Option to create an account** If I travel regularly, I have the option to set up an account and include preferences. I can register my payment card and ticket media for travel. I can record my family members, concessions and notification preferences etc.	**Pre purchase - single payment for whole journey** A 'one stop shop' enables me to make a single payment for an end to end journey. I can pay online or on mobile when and where I want and receive ticket confirmation communications. I can take advantage of best value advance fares and reserve a seat or cabin for example if travelling by ferry. I can easily make changes to my journey and request a refund if needed.	**Pre-purchase - choice of tickets** I can select my preferred ticket media such as smart card or mobile tickets. I will have easy pre-paid travel across all my travel legs.	**Simplified customer service** I can choose my preferred channel for customer support – email, online, phone. I can access centralised support to cover my whole end-to-end journey across different operators & modes. I can look online for journey planning, payment guidance and FAQs. I can see my journey and payment history
Additional travel information I can see bus stop, station, airport, ferry terminal and local information. Options on payment, how to hail a bus or request a stop allow me to be prepared. There is help on the start and end of journey. Options such as demand responsive travel and local cycle share schemes for example.				

12. Conclusion and next steps

The conclusion and next steps for this options and recommendation report are detailed in this section.

12.1 Conclusion

The recommendations made in this report, provide a clear incremental approach to implement the Transport Scotland aggregator project. This is illustrated in the following schematic.



Stage 1 provides a mechanism for real-time, dynamic pricing information to be provided by operators. This is a best practice approach supporting advanced purchase and demand-based pricing models. Presently these models are only used by rail and airlines however it is feasible that coach, ferry and demand-based transport systems might offer similar fares in the future. Stage 1 is constrained by the lack of published NeTEx UK profile and its industry adoption. In the meantime, several small changes are proposed to the fare triangle file-based fare sharing process. These changes are intended to reduce the manual involvement in processing these files therefore improving accuracy and throughput. With greater throughput comes the ability to process more files and enrich the dataset held by Traveline Scotland. Traveline Scotland should prepare for the use of NeTEx provided data and make use of it where available.

Stage 2 looks to enhance static information on operator and service to make public transport, especially bus, more accessible to all, especially the car driving public. Information on payment options available onboard and even how to hail a bus or ask it to stop at your stop will demystify things for the non-confident user. An enhanced mechanism for displaying additional information based on geographic zone is proposed. This could be used to promote regional services, zonal tickets, bike share schemes, DRT-NG services and even retail promotions. Stage 2, recommends a mechanism to redirect retail of tickets through to an operator web site. This method is in use elsewhere on sites like SkyScanner or National Rail Enquiries. It is a relatively straightforward step that would test the water for a more comprehensive ticket retail function on Traveline Scotland as proposed in stage 3.

Stage 3 presents the challenges associated with ticket retail and fulfilment on a Traveline Scotland platform for fulfilment by individual operators. Contrasting with this single purchase of complete journey is the concept of Account Based Ticketing (ABT).

Considering the effort, complexity and therefore cost associated with implementation of the single purchase concept, it is our recommendation that any implementation is paused after stage 2. Time should then be taken to consider the benefits that have been derived thus far. The progression of NeTEx can also be explored. Stage 3 would again be compared to latest ABT developments in the industry and ongoing trends.

For each of these stages, use case alignment, development effort, benefits analysis and strategy alignment have been considered to assist in option selection.

For all the stages above, processes and business practices will be required to handle new operators emerging, operators ceasing to trade, operator take over, operator change of key suppliers, changes to contracted services etc. For the bus industry, the Traffic Commissioner publishes a national data set of operator registrations though it does not look like this data has been updated on data.gov.uk since 2014. Such a source of data can be used to find what operators and services have been added or removed on a fortnightly basis and this information used to drive workflow to incorporate them into the Traveline Scotland data set correctly.

New operators will need to be onboarded correctly which may involve system integration effort. An operator changing a supplier will require that operator to inform TLS such that necessary changes can be identified and implemented.

12.2 User experience / user interface review

It is recommended that a review of the current Traveline Scotland user interface is undertaken. This work would cover both web browser and mobile app interfaces.

For the success of any of the initiatives in this discovery project, it is essential that the customer realises the benefit. The user interface is the key to this. Navigation has to be intuitive and information presented needs to be uncluttered and appropriate. Ideally the same design patterns, iconography and metaphors should be applied to both web and mobile interfaces.

The following approach is typical of a UX/UI engagement project.

Step	Summary	Description
1	Gather requirements	What is the typical activity? Why are we doing it? Who are the target customers? Create personas. What are the target interface devices? Any technical restrictions?
2	Research	Pros and cons of the current implementation. Best practice elsewhere?
3	Low fidelity design	One or more cycles of design, feedback, iterate.
4	User test	Using focus groups / potential users, observe usage of design and record hesitations or confusion, etc.
5	High fidelity design	One or more cycles of design, feedback, iterate.
6	Prototype	Using a rapid prototyping tool, turn the evolved design into a working model.
7	User test	Using focus groups / potential users, observe usage of design and record hesitations or confusion, etc.
8	Iterate	Keep iterating until returns diminished.

It is anticipated that such an activity would take up to 4 weeks of effort depending on the number of anticipated design cycles that would be acceptable. Approximate costs for such an engagement are expected to be modest and will be covered separately (for supplier confidentiality purposes).

The quick wins outlined in the next section are not dependant on this review although they would greatly benefit from it.

12.3 Quick wins

This discovery project recommends the following initiatives are carried out as quick wins. They are all considered low cost and do not fundamentally change the architecture operated by Traveline Scotland.

Quick win	Description	Costs	Timescales
PlusBus support.	As described in section 2.5, PlusBus would allow rail journeys that start or end with a bus journey to be fulfilled using a single ticket. There is a finite list of stations where PlusBus is valid and this is expected to drive the activation of this functionality. It is considered to be a relatively straightforward integration activity. Costs include a level of contingency and effort on behalf of Traveline Scotland to manage the project.	<£30k	~1 month
Extended service information (part of stage 2)	Situation console factilities can be used to provide enhanced operator and service level information regarding on-bus facilities. This should be extended to support information on cash, exact fare and bus etiquette information. Note there is overlap with some existing facility used by Traveline but this recommendation aims to improve on this further. Operators can be canvased via an online survey to capture the initial information to be included at operator level. A more granular, service level of information would require an operator completing a template or the provision of a web portal for data capture. The budgetary costs here do not cover the provision of such a web portal.	~£10k	~2 weeks
Zonal overlay extensions (part of stage 2)	The generic model proposed for zonal overlays will give the ability to present multi-operator and regional zone-based tickets to a customer. In addition, it would allow for cycle share schemes to be defined and presented if applicable to a journey. Costs include a level of contingency and effort on behalf of Traveline Scotland to manage the project.	<£50k	~2 months
Improved DRT and DRT-NG support	A project is currently in progress to provide DRT (dial-a-ride) service options to a customer if the planned journey meets certain criteria. The recommendation is to provide a more comprehensive presentation of both DRT and DRT-NG options in a way that supports public transport and encourages its use. It is understood that there is a conflict between public transport and private hire. Using private hire for a short leg to public transport hub might mean someone does not take their car for the entire journey. Costs have not been pulled together for this but will probably build on the existing project work that is in flight.		

12.4 Next steps

This report considered the design options for each stage of the solution and made recommendations for the preferred option. The recommendations in this report will be used to develop the next deliverable of the Aggregator project – the Technical Specification, which will contain:

- Architectural components
- Security considerations
- Technologies and protocol options
- Standards (where applicable)
- Scheduling considerations
- API / data mode

Some of the above points are dependent on the supplier community assisting with provision of existing APIs where they are available and effort estimates where necessary.

Upon completion of the Technical Specification, an indicative outline project delivery plan will be defined which will contain:

- Outline plan
- Estimated outline costings
- Milestones
- Resources

13. Annex 1 Account Based Ticketing

Transport Scotland requested that the ABT should not be considered as a formal option in this report but should be included in the overall conclusions. Additional ABT context and processes are included in the following sections.

13.1 Account based ticketing context

ABT enables a pay for where you travel model with best value and fare capped guarantee for walk-up fares, enhanced with ticket offsetting (such as against season ticket purchases) and virtual tickets. A common operator acceptance of travel token will be required.

This has been widely accepted as successful in London with the ABT system providing best value fares based on travel. This compares to having to guess your travel pattern in advance and hoping you guessed best value.

Best value fare involves a process of journey construction based on travel events (taps) then rating these journeys and applying capping rules and other business logic. Capping can be done on a daily, weekly or monthly basis. This model works well in an urban environment where each journey is of low value.

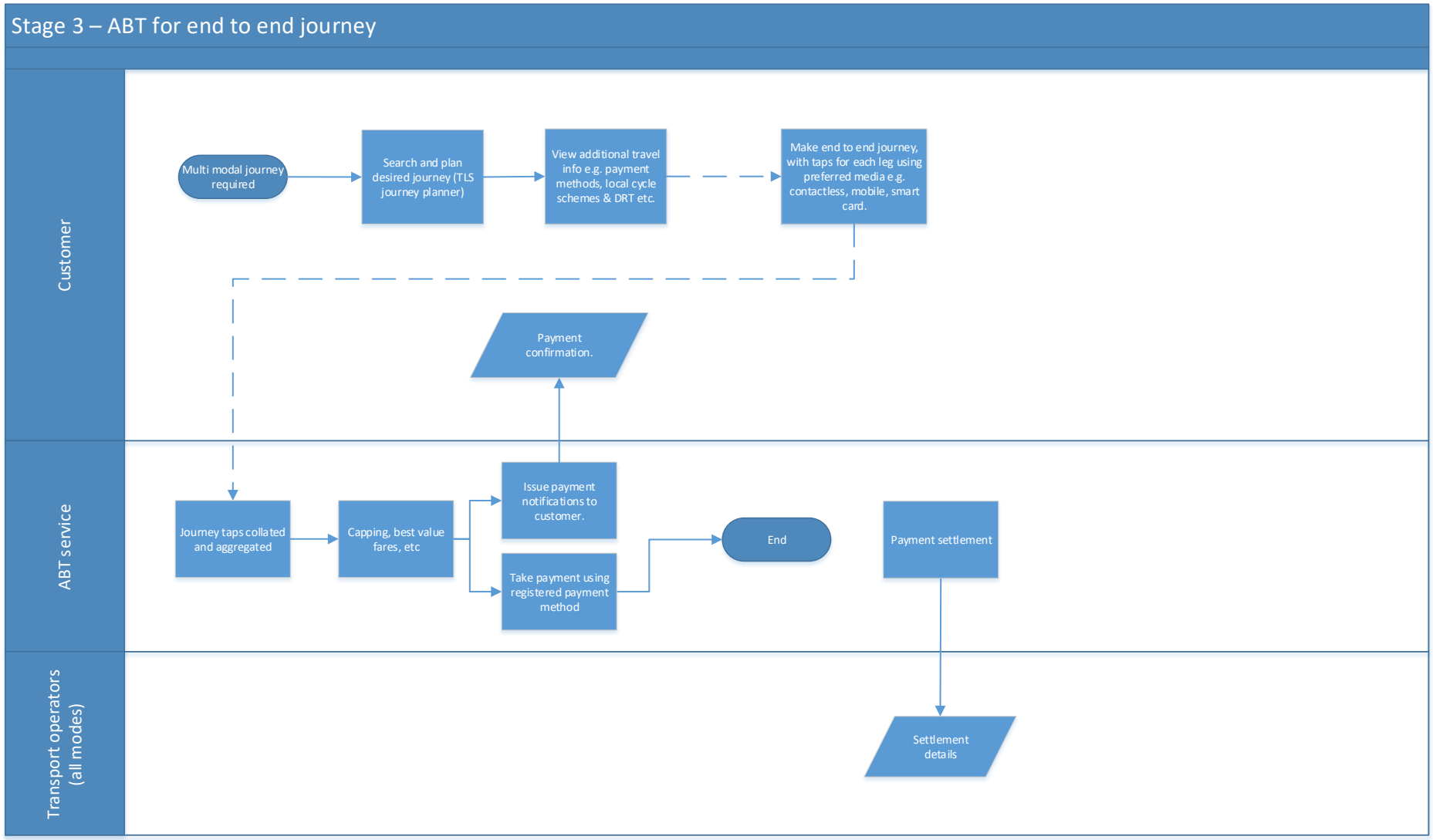
ABT solutions can provide ticket offsetting where a product such as a season ticket or advanced purchase fare can be registered “on account”. Any travel undertaken would then take this registered ticket into consideration when establishing fares owed. An example is the purchase of a season ticket A->B for normal travel but on one day, travel takes place from A->C. In this case, the A->B leg is already paid so the charge would be just B->C.

ABT can work inter-city but requires wider supporting infrastructure for common acceptance of tokens.

Travel tokens can be an ITSO card, an cEMV card or other form of identifying media. cEMV is popular due to its direct linkage to a payment mechanism and the fact that someone else (the banks) are providing the card issuance. In using cEMV, there is a liability shift and risk model offered by the acquirers that is different to a pure ticket purchase model (cEMV model 1). It is possible for operators or transport authorities to agree a risk model outside of cEMV guidelines.

13.2 Account based ticketing processes

An initial process for full API integration between TLS and operators to support ABT, together with a description are detailed below. This contrasts with the description of single purchase of tickets covering multiple legs as detailed in stage 3.



Process task	Process task description	Responsibility
Search and plan desired journey (TLS journey planner)	The customer will search and plan their desired journey using the TLS journey planner. There is an option to select a journey based on fastest speed or cheapest option. The fares for each leg and overall cost will be displayed.	Customer
View additional travel info e.g. payment methods, local cycle schemes & DRT etc.	The customer can view additional travel information associated with the selected journey option. This may include: • local transport mode facilities • walking times to guarantee connections • transport mode payment methods • guidance on first and last leg of journey options such as cycle schemes and DRT options.	Customer
Make end to end journey, with taps for each leg using preferred media e.g. contactless, mobile, smart card.	The customer will make the end to end journey and tap in/out as per the requirements for each leg of the journey. The customer can use a preferred ticket media travel token such as contactless, mobile, smart card etc.	Customer
Journey taps collated and aggregated	Multiple taps throughout the travelling day are collected and used to build a journey pattern.	ABT service
Capping, best value fares, etc.	Business rules in the ABT service will perform rating, capping and best value fare calculations to construct an account balance for each customer account.	ABT service
Issue payment notifications to customer.	Account payment notifications will be issued to the customer based on customer notification preferences. This can indicate what charges have been made and how these have been constructed.	ABT service
Take payment using registered payment method.	Payment will be taken for the outstanding account balance using a registered payment method.	ABT service
Payment settlement.	Revenue obtained from customer accounts will be settled back to operators according to agreed business rules.	ABT service

14. Annex 2 Supporting material

14.1 Operator participation willingness

As part of the discovery assessment operator questionnaire, the willingness of operators to share fare and ticketing information in future (where not currently shared), was assessed. The results of this question are summarised in the table below.

Transport mode	Willingness to share fare and ticketing data	
Air	1/1	100%
Ferry	2/3	66%
Bus	24/54	44%
Coach (not bus operators)	2/3	66%
DRT (not bus operators)	1/6	16%
Total (of above categories)	30/67	45%

As identified in the relevant risk sections, additional financial support may be required to support the implementation recommendations for small operators.

14.2 Mapping of retail options

The following table provides a picture by mode of the acceptance of smart cards for both commercial and concessionary travel. A more detailed assessment is contained in the Discovery assessment report.

Transport mode	Smart (concessions)	Smart (commercial)
Air	No	No
Ferry	Some	No
Bus	Yes	Some
Coach (not bus operators)	Yes	No
DRT (not bus operators)	Some	Some
Rail	Yes	Yes
Subway	Yes	Yes
Tram	Yes	Yes (not ITSO)

The following table provides a picture by mode of the retail options available for ticket purchase. A more detailed assessment is contained in the Discovery assessment report.

Transport mode	Direct to public (e.g. Travel Shop)	Via web site	Via smart phone	On boat/vehicle /train	Via call centre
Air	Yes	Yes	Yes	No	Yes
Ferry	Yes	Yes	Planned	Yes (for some services)	Yes
Bus	Yes (for some ticket types)	Yes (for some ticket types)	Yes (for some ticket types)	Yes	No
Coach (not bus operators)	Yes	Yes	No	Yes	Yes
DRT (not bus operators)	No	No	No	Yes	Yes
Rail	Yes	Yes	Yes	Yes	Yes
Subway	Yes	Yes	Yes	No	No
Tram	Yes	Yes	Yes	Yes	No

14.3 Assessment of existing Traveline Scotland systems

During the course of this discovery project, Fujitsu have had opportunity to discuss the aims and recommendations with Traveline Scotland and their incumbent supplier. The following assessment is given with regard to expanding existing fares datasets for all modes.

Topic	Assessment
Contracts	Traveline Scotland has experience in contracting suppliers to provide systems and services that underpin its public services. There is an established change control process under which new features can be developed and introduced. Changes appear to be possible to any area of the service or system subject to commercial consideration.
Data factory processes	Current data factory processes (for processing schedules and fares from operators) are too manual and reliant on people and knowledge. These processes need to be automated where possible to allow the service to expand and include additional fares. 26 operators provide 90% of the national fares so to increase this to 100% will involve processing data from hundreds of small operators, most of which will have limited technical capability in their own organisation. For this reason, the recommendations in stage 1 have been to standardise on a file format and use real-time lookup where possible.
System scalability	The current platform supports a significant number of web and mobile app visits and subsequent journey plans. There is no reason to doubt that the current platform can scale to meet additional demand that might result from the initiatives outlined in this discovery project.
Technical capability	The current platform providers have the industry knowledge required and the familiarity with modern web programming and API standards to address the recommendations in this report.
UX/UI	It is acknowledged by both Traveline and their supplier that the user interface has suffered from information expansion and is not looking clean and tidy. There are inconsistencies between the web site and the mobile app in both planning a journey and reviewing the results. The mobile app does not look great on the latest 2019 devices as it is using compatibility modes for display sizes. The success of any project initiatives will be limited by the user interface, so this is a key area that needs to be addressed.

