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Technical document

TAP RETAIL ARCHITECTURE

*In the Document History table, version are identified as x.n where
“x” is a correlative number assigned to an approved version when reaching a main milestones
“n” is a correlative number assigned to draft versions, starting by 1. “n”=0 means version approved
Information related to previous draft versions (i.e. 0.1, 0.2 etc.) shall be deleted from the table when a
subsequent approved version is issued.*

Document History

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Contents

1.	Introduction	7
2.	References.....	7
2.1.	References.....	7
3.	Particular description of the subject.....	8
4.	Purpose	8
5.	Context.....	8
6.	Scope	9
7.	Actors and Landscape	9
7.1.	Actors definitions, goals and roles	9
7.2.	Actors landscape	12
7.3.	Interaction overview	13
7.4.	Resources	13
7.4.1.	List of resources	13
7.4.2.	Register Resource	15
7.4.2.1.	Timetable Resources	16
7.4.2.2.	IRT Tariffs/Fares Resources.....	16
7.4.2.3.	NRT Fares Resources	16
7.4.2.4.	Special Tariffs/Fares Resources.....	16
7.4.2.5.	Domestic Tariffs/Fares Resources.....	17
7.4.2.6.	Accessibility data Resources	17
7.4.2.7.	Reservation Resources	17
7.4.2.8.	Public Key Resources.....	17
7.4.2.9.	Retail Reference Data Resource.....	17
7.4.2.10.	Data Quality Management Resources	17
7.4.2.11.	Access Methods	17
7.4.2.12.	File Transfer Access Method	18
7.4.2.13.	Web Service Access Method	18
7.4.2.14.	E-mail Access Method	18
7.4.3.	Resource Subscriptions	18
8.	Business Rules	19
8.1.	Resource registration, subscription and access.....	19
9.	Functional Requirements and Use Cases	20
9.1.	Functional requirements.....	20
9.2.	Use cases.....	22
9.2.1.	Membership Registration	22
9.2.2.	Register a resource	23
9.2.3.	Subscribe to a resource.....	24
9.2.4.	Notify subscribers	24
9.2.5.	Retrieve a resource	25
9.3.	Data Quality Management.....	26

9.3.1.	Functional Requirements	26
9.3.2.	Use cases	27
9.3.2.1.	Submit resource to quality checks	28
9.4.	Retail Reference Data	28
9.4.1.	Functional Requirements	29
9.4.2.	Use cases	29
9.4.2.1.	Get reference data	29
9.5.	Common Components of the TAP-TSI Retail Architecture and their interaction	31
9.5.1.	Overall interaction	33
9.5.1.1.	Actors ask for membership in the Registry	33
9.5.1.2.	Actors request information from the Registry	33
9.5.1.3.	Actors get reference data from the RRD	34
9.5.1.4.	Actors check quality of Resources (Timetables and Tariffs/Fares)	36
9.5.1.5.	Producers make available their resources on a data server	37
9.5.1.6.	Notification process for any changes in resources	38
9.5.1.7.	Consumers get Resources from Producers at the appropriate locations	39
9.5.1.8.	Consumers get a specific resource (Reservation and IRTs) via an interactive interface at an appropriate reservation system	40
9.5.1.9.	Printing ticket	41
10.	Non Functional Requirements for the TAP retail architecture	43
10.1.	Conditions for Access to the Registry	43
10.2.	Quality of Service requirements	43
10.3.	Volume of Exchanges	45
10.4.	Service capacity	45
10.5.	Support level	45
11.	Obligations of the Registry Service Provider	45
11.1.	Definitions	45
11.1.1.	Sign-up and Approval – Registry User Entity and Administrator	46
11.2.	Sign-up and Approval – Registry User	47
11.3.	Effecting, Amending and Discharging Registrations – Registry User	47
12.	Sizing assessment	48
12.1.	Stakeholders	48
12.2.	Number of resources to be handled	48
13.	Provisions for administrators and Consumers of Registry services	49
13.1.	Service to Consumers	49
13.2.	Service Administrators	49
14.	Migration from existing situation to TAP TSI environment	50
14.1.	Registering to the TAP ecosystem through TSGA	50
14.2.	Subscribing to a notification for chosen resources	51
14.3.	Getting the Reference data from RRD	51
14.4.	Checking quality of Resources (Timetables and Tariffs/Fares)	51
14.5.	Making available Resources	51

14.6. Informing the Registry of a new Resources available.....	51
ANNEX 1 – GLOSSARY.....	51
ANNEX 2 53	
Resource Deliveries	53
Resource Subscriptions	54
Resource Producers and Consumers.....	55
Timetable Resources	56
IRT Tariffs/Fares Resources	57
Access Methods.....	59

Application:

With effect from **08 March 2012**.

All actors of the European Union falling under the provisions of the TAP TSI.

Table 1: Abbreviations

<i>ABBREVIATION</i>	<i>FULL TEXT</i>
AC	Alternating Current
CCS	Command Control and Signalling
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CEPT	European Conference of Postal and Telecommunications Administrations (Conférence européenne des administrations des postes et des télécommunications)
CER	The Community of European Railway and infrastructure companies
COST	(European Cooperation in the field of Scientific and Technical Research) (Coopération européenne dans le domaine de la recherche Scientifique et Technique)
CR	Conventional Rail
DC	Direct Current
DeBo	Designated Body
DMI	Driver-Machine Interface
EC	European Commission
EEA	European Economic Area
EEC	European Economic Community
EEIG	European Economic Interest Group
EIM	European Rail Infrastructure Managers
EIRENE	European Integrated Radio Enhanced Network
EMC	Electro Magnetic Compatibility
EN	European standard
ERA	European Union Agency for Railways also called “the Agency”
ERADIS	Interoperability and Safety database managed by the European Union Agency for railways
ERATV	European Register of Authorised Types of Vehicles
ERTMS	European Rail Traffic Management System
ESO	European Standardisation Organisation

<i>ABBREVIATION</i>	<i>FULL TEXT</i>
ETCS	European Train Control System
ETS	European Telecommunications Standard
ETSI	European Telecommunications Standards Institute
EU	European Union
FFFIS	form fit functional interface specification
FFFS	form fit functional specification
FIS	functional interface specification
GSM-R	Global System for Mobile communications - Railway
HD	Harmonisation Document
IC	Interoperability Constituent
IEC	International Electrotechnical Commission
IM	Infrastructure Manager
INF	Infrastructure
ISO	International Organisation for Standardisation
ISV	Intermediate Statement Verification
JPC	Joint Programming Committee of CEN/CENELEC/ETSI
JPCR	Joint Programming Committee Rail
JWG	Joint Working Group
MS	EU or EEA Member State
NoBo	Notified Body
NB-Rail	Coordination group of notified bodies for railway products and systems
NNTR	Notified National Technical Rule
NSA	National Safety Authority
NSR	National Safety Rule
NTR	National Technical Rule
OJ	Official Journal of the European Union
PRM	Person with Disabilities or Person with Reduced Mobility
QMS	Quality Management System
RAMS	Reliability, Availability, Maintainability and Safety
RFU	Recommendation for Use
RINF	Register of Infrastructure
RISC	Railway Interoperability and Safety Committee
RR	Revision Request

<i>ABBREVIATION</i>	<i>FULL TEXT</i>
RRA	Revision Request Author
RS	Rolling Stock
RU	Railway Undertaking
SC	Standard Committee
SRT	Safety in Railway Tunnels
SS	Subsystem
STM	Specific Transmission Module
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
TSI	Technical Specification for Interoperability
UIC	International Union of Railways (Union Internationale des Chemins de Fer)
UIP	International Union of Private Wagons Owners (Union Internationale d'associations de Propriétaires de wagons de particuliers)
UIRR	International Union of Combined Road–Rail Transport Companies (Union Internationale des opérateurs de transport combiné Rail-Route)
UITP	International Association of Public Transport (Union Internationale des Transports Publics)
UNIFE	Union of the European Railway Industries (Union des Industries Ferroviaires Européennes)
UNISIG	Union Industry of Signalling (working party within UNIFE): steering committee involved in the development and implementation of ERTMS
WG	Working Group
WP	Working Party

1. Introduction

The present document belongs to the set of Technical Documents described in Annex V „LIST OF TECHNICAL DOCUMENTS FOR RETAIL ARCHITECTURE, GOVERNANCE AND MASTER PLAN“ of the **COMMISSION REGULATION (EU) No 1273/2013**.

2. References

2.1. References

<i>Ref. N°</i>	<i>Document Reference</i>	<i>Last Issue</i>
[1]	Directive (EU) 2016/797 on the interoperability of the rail system within the Community	

<i>Ref. N°</i>	<i>Document Reference</i>	<i>Last Issue</i>
[2]	Commission Regulation (EU) No 454/2011 of 5 May 2011 on the technical specification for interoperability relating to the subsystem 'telematics applications for passenger services' of the trans-European rail system	
[3]	ERA/TD/2012-13/INT ANNEX B.61 of TAP TSI TAP TSI Governance	Version 2.0

The above documents can be downloaded from the website of the European Rail Agency at <https://www.era.europa.eu/Document-Register/Pages/TAP-TSI.aspx>.

3. Particular description of the subject

This IT specification is dedicated for the implementation of the TAP TSI retail architecture.

4. Purpose

The purpose of this document is to describe the TAP TSI Retail Architecture. It supports interoperability according to the specifications of the TAP TSI Basic Parameters and the provisions described in the Technical Documents (TDs). It facilitates all Actors to comply with the regulation, describes how to fulfil their obligations and allows them to exercise their rights.

5. Context

TAP TSI Architecture specific Basic Parameters are the following:

Chapter 4.2.21.1. General architecture

The proposed 'Information Exchange Architecture':

- *is designed to reconcile heterogeneous information models by semantically transforming the data that are exchanged between the systems and by reconciling the differences in business processes and application- level protocols,*
- *has a minimal impact on the existing IT architectures implemented by each actor,*
- *safeguards IT investments already made.*

The Information Exchange Architecture favours a mostly Peer-to-Peer type of interaction between all actors, while guaranteeing the overall integrity and consistency of the rail interoperability community by providing a set of centralised services.

A Peer-to-Peer interaction model allows the best distribution of costs between the different actors, based on actual usage and, in general, will pose fewer scalability problems.

Chapter 7.2.3

Deliverables shall include the outline of the global architecture of the system. It shall describe how the requisite components interact and fit together. This shall be based on the analysis of the system configurations capable of integrating the legacy IT facilities, while delivering the required functionality and performance.

The document defines consequently the architecture that will be used to exchange rail data according to those Basic Parameters.

This document is intended for the use of:

- › RUs when acting as “Resource Producers”, delivering resources such as Timetables, Tariffs/Fares
- › Distributors acting as Producers, delivering Public Keys for Digitally Signed Ticket Print@home
- › Public Authorities, Ticket Vendors, RUs acting as “Consumers” of Resources
- › TSGA (TAP TSI Services Governance Association) when acting as the “facilitator” to all Actors in the TAP TSI

In order to come to an accurate identification of the “data exchange architecture” for the Basic Parameters of TAP TSI Phase One, and to generate data exchange Procedures from it, it is important to qualify the expression “data exchange” by identifying type of interactions:

- › File exchange. These are used for asynchronous copying of data organised in files across systems. For instance sFTP (Secure File Transfer Protocol) for timetable data or any other similar method for file sharing, however, with the usage of the Secure Socket Layer (SSL).
- › Transactional service requests using a synchronous or asynchronous request/reply message exchange for the reservation request.

The Architecture is designed as a business logic neutral interoperability infrastructure that can be extended to support the evolution of new Resources, new Technical Documents (i.e. changing from one data structure format to another)

6. Scope

This document presents a high level view of the TAP TSI Retail architecture: decentralised exchange of rail business data with a central registry.

The TAP TSI retail architecture covers the exchange of rail business data, defined as Resources (timetable, fares...), between RUs and third parties e.g. other RUs, Ticket Vendors, Public Authorities.

The architecture also describes possibilities for the TSGA to facilitate data provisioning and quality.

The architecture provides support to but does not cover:

- › Production of the data, including reference data
- › Assembling complete train schedule from different timetable resources
- › Internal processes for the resource producers to fulfil the EU rail legislation requirements in TAP TSI on data provisioning (12-months history (TAP TSI chapter 4.2.1), NRT data to publish 3 months before they are applicable (TAP TSI Annex IV)
- › Settlement (not part of TAP TSI)
- › Intellectual Property Rights issues of data provided by the resource producers
- › Software development cycles
- › TAP TSI Governance process definition

7. Actors and Landscape

7.1. Actors definitions, goals and roles

Actor	Description	Goals
AC1	Resource Producer TAP TSI Actor that makes Resource available to Resource Consumers by registering Resource together with one or	<ul style="list-style-type: none"> ▪ Makes a Resource available to those Resource Consumers who are entitled to it under bilateral agreements and/or the

<p>more Access Methods, in the Registry.</p> <p>Resource Producers include;</p> <ul style="list-style-type: none"> • Schedule “Information” Providers • Fares and Tariff data providers • Reservation system Providers • PRM assistance service Providers • Ticket Controlling Organisations providing Control Certificates • Distributors providing Public Keys to Ticket Controlling Organisations • Providers of Reference Data 	<p>TAP TSI Regulation</p> <ul style="list-style-type: none"> ▪ Register a Resource ▪ Request quality validation report on a Resource from Data Quality Manager
<p>AC2 Resource Consumer</p> <p>TAP TSI Actor that consumes data produced by Resource Producers.</p> <p>They can do so by:</p> <ul style="list-style-type: none"> • Receiving notifications of Resources being made available or updated when subscribed to their updates • Retrieving a Registry entry to obtain the location and Access Methods to use in order to know where said Resources are made available by Resource Producers <p>Resource Consumers include:</p> <ul style="list-style-type: none"> • Public Authorities • Railway Operators • Ticket Vendors 	<ul style="list-style-type: none"> ▪ Subscribe to availability and updates to Resources whether they are entitled or not to receive under bilateral agreements with Resource Producers and TAP-TSI Regulation ▪ Retrieve Registry entries to determine Access Method to Resources ▪ Use retrieved Access Method to access Resources from a chosen Resource Producer ▪ ask quality validation report on a Resource from Data Quality Manager
<p>AC3 Data Quality Manager</p> <p>A specialised Resource Producer that provides an interface and/or service (a type of Resource) to perform quality checks and generate quality reports and logs on Resources. It can be used by both Resource Consumers and Resource Producers.</p>	<ul style="list-style-type: none"> ▪ As a Resource Producer, register interface to Data Quality validation and reporting procedure ▪ Produce data quality report on Resources submitted to it for quality validation.
<p>AC4 TSGA</p> <p>It is a facilitator assisting all actors in the TAP TSI ecosystem to be compliant with the TAP TSI Regulation</p>	<ul style="list-style-type: none"> ▪ As a Resource Producer, register and make available Resources it controls, such as Code Lists and Reference Location Data. ▪ As an entitled Resource Consumer under the TAP TSI Regulation, subscribe to Resource updates, obtain Registry entries and access Resources
<p>AC5 Registrar</p>	<ul style="list-style-type: none"> ▪ As an entitled Actor, providing operational day to day support with

person in the Registry Service Provider organisation appointed by the TSGA to supervise the working of the Registry

registered actors, and helping new actors to be registered

7.2. Actors landscape

The landscape describing Actors is illustrated below.

There is a direct relationship between Resource Producers and Resource Consumers based on commercial agreements and the TAP TSI Regulation.

All Actors needs to subscribe to the Registry in order to at least get the Reference Data and other Services.

Resource Producers e.g. RUs register their Resources.

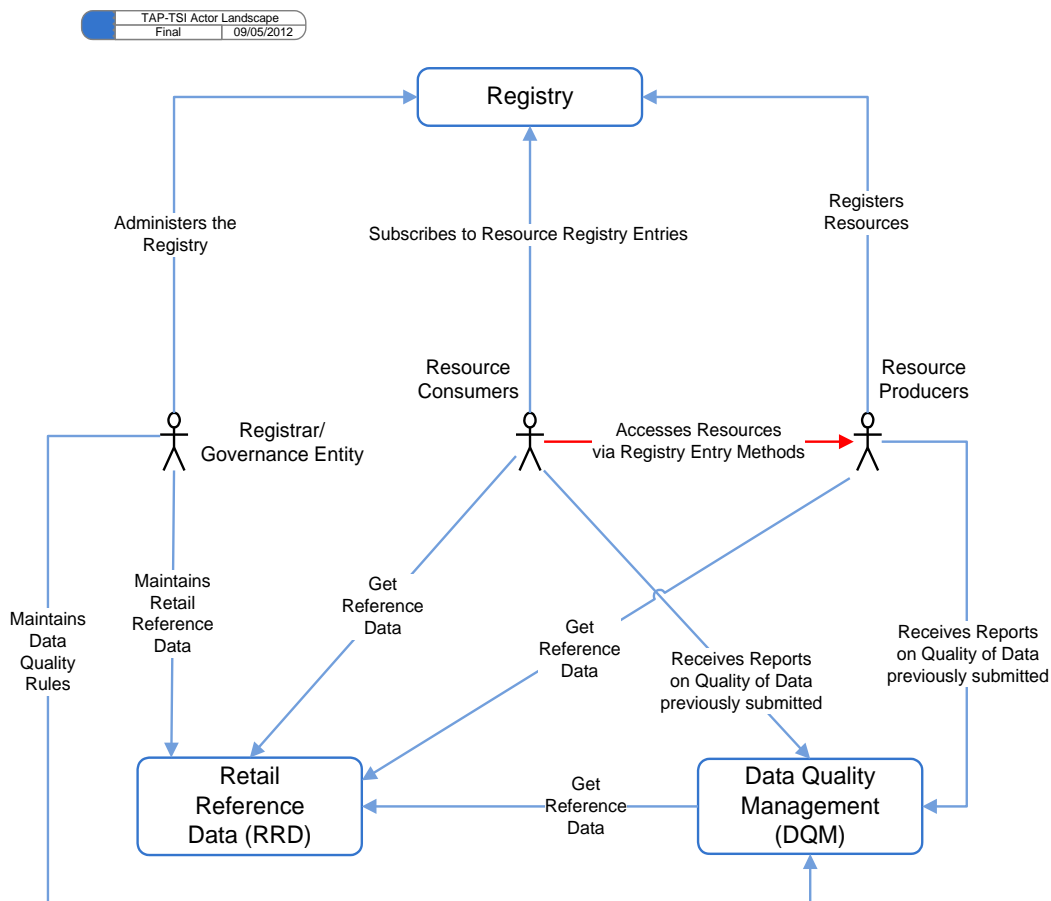
Resource Consumers subscribe to the Resource Registry entries.

Both Resource Producers and Consumers can submit their Resources to the DQM for a report on data quality.

Both Resource Producers and Consumers get Reference data from the RRD

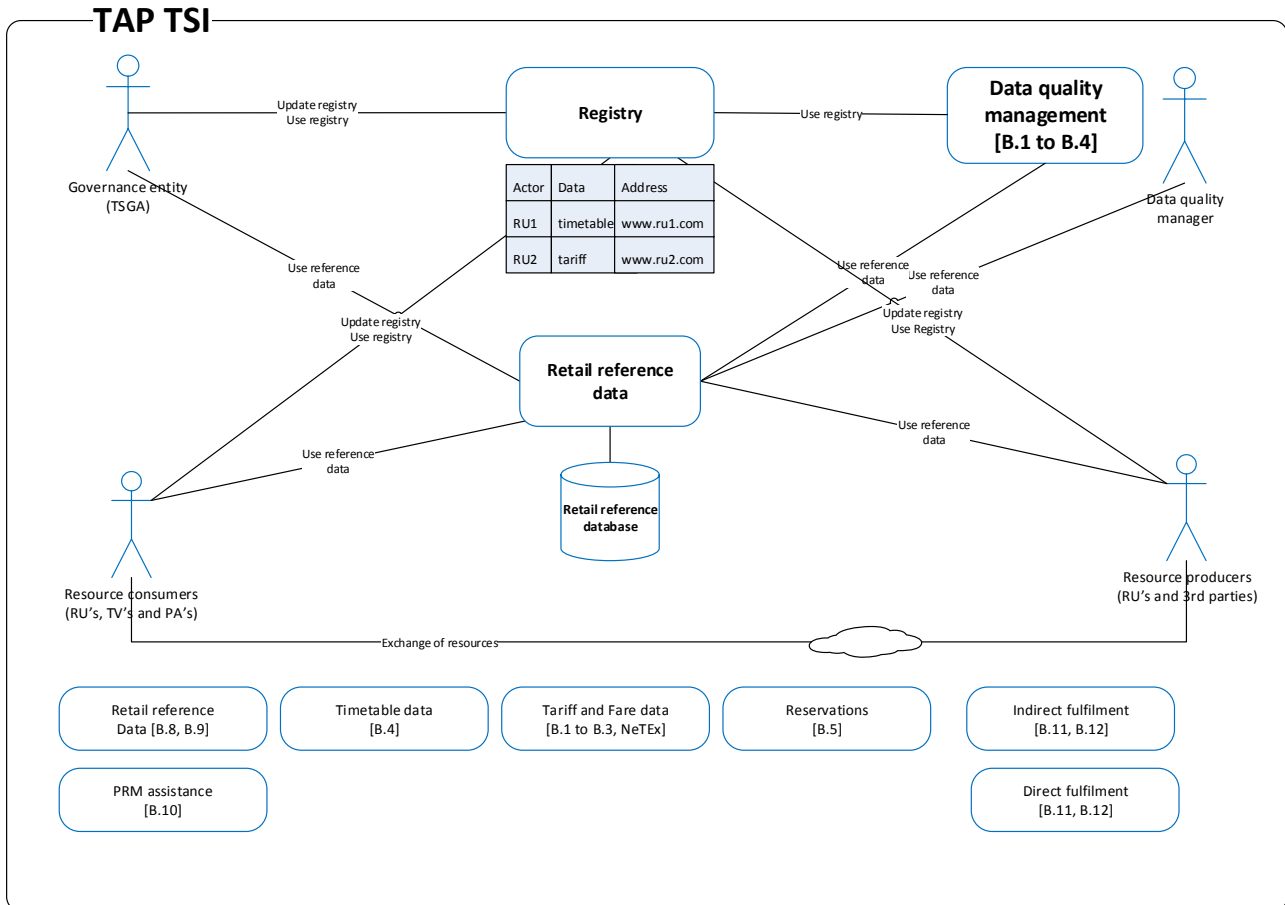
TSGA/ Registrar administers the Registry:

- Registrar provisions Membership credentials
- TSGA monitors activity (Registry, DQM, RRD)
- TSGA maintains RRD and DQM



7.3. Interaction overview

The following drawing shows the perimeter of the current proposed Architecture that matches the requirements of the Regulation (inside the TAP-TSI frame) and subjects that are not part of the Regulation (outside the TAP-TSI frame). Data to be exchanged between Resource Producers and Resource Consumers have a reference to the Technical Documents and the type of data mentioned in Basic Parameters.



Resource Producers produce resources and make them available in the format described in Technical Documents defined in the Regulation. They register their resources in a central registry, so that resource consumers know where and how to fetch them.

The quality of the data can be verified by the use of the Data Quality Management tool procured by the TSGA.

The resource consumers consult the registry to know how to get the resources. Alternately, they can subscribe to resources in order to receive a notification from the registry on resource update.

They can in turn retrieve the resources using the access method given by the registry.

Subscription to a resource is optional. Once subscription is made, the notification is automatic.

7.4. Resources

7.4.1. List of resources

The table below lists the available resources and their functionality, as well as the message formats which must be indicated in the Registry and respected by the resource producers. The architecture should be designed so that the integration scenarios can adapt as needed.

Theme	Resource	Functionality	Format
Timetable	Timetable	Planned timetable, made available by Producers on a regular basis or when needed. Applicable for information.	B.4
Tariffs and fares	NRT	NRT tariffs and fares; suitable for sales. Made available on a regular basis or when needed.	B.1
	IRT	IRT tariffs and planned fares; applicable for information only. Made available at any time.	B.2
	Special offers	Special tariffs and planned fares, applicable for information only made available at any time.	B.3
Retail Reference data	Passenger code lists	List of values for data used in Technical Documents Required to read timetable and tariffs, perform reservation and ticketing	TD_PassengerCodeList
	Country codes	Required to read timetable and tariffs, perform reservation and ticketing	ISO Codes
	Location codes	Required to read timetable and tariffs, perform reservation and ticketing Translate to operational locations	B.9 or TAP TSI Retail Reference Database (RRD)
	Company codes	Required to read timetable and tariffs, perform booking and ticketing	B.8 or TAP TSI Common Reference Database (CRD)
e-Fulfilment data	Public keys for print@home	Certificates that allow the Ticket Controlling Organisation (TCO) to read a P@H ticket for DST method. Availability: depends on bilateral agreements.	Depends on bilateral agreement B.7
	Other print@home data	Interactive, on-demand transactions with the inventory systems	B.7
Booking	Inventory system	Interactive, on-demand transactions with the inventory systems, for IRTs and Reservation only	B.5
PRM assistance	PRM systems	Interactive, on-demand transactions between systems according to the standard recommended by the Regulation	B.10
Data Quality Management tool	Data Quality	Resource procured by the Governance	

The above message formats and their appropriate use and implementation are described in the following TAP TSI IT Specifications:

Format	ERA TAP TSI technical document (title, year, version)
Timetables	<i>TAP TSI ANNEX B.50 - IT SPECIFICATION FOR EDIFACT MESSAGES COVERING TIMETABLE DATA EXCHANGE</i>
Tariffs	<i>TAP TSI ANNEX B.51 - IT SPECIFICATION FOR TARIFF AND FARE DATA EXCHANGE</i>
Direct Fulfilment	<i>TAP TSI ANNEX B.53 - IT SPECIFICATION FOR DIRECT FULFILMENT</i>
Indirect Fulfilment	<i>TAP TSI ANNEX B.54 - IT SPECIFICATION FOR INDIRECT FULFILMENT</i>
Reservation	<i>TAP TSI ANNEX B.52 - IT SPECIFICATION FOR ELECTRONIC RESERVATION OF SEATS/BERTHS AND ELECTRONIC PRODUCTION OF TRAVEL DOCUMENTS - EXCHANGE OF MESSAGES</i>
PRM assistance	<i>TAP TSI ANNEX B.55 - IT-SPECIFICATION FOR PRM ASSISTANCE</i>

7.4.2. Register Resource

Resources listed in the previous chapters are delivered by Resource Producers according to the specification of the IT Specifications applicable for the specific Resource, which determine the Delivery contents for each type of Resource (i.e. whether a Resource such as a Timetable is a complete Timetable for a particular Resource Provider, or an incremental update).

Registration of a Resource consists of creating a Registry entry called a “Resource Delivery” which is an association of a Resource Producer and a list of Resource entries, each representing a Resource being made available such as Timetables, Fares etc.

A Resource entry should be generic and should represent any type of Resource, and contain a “Resource Name” attribute indicating its name (e.g. “TIMETABLE”, “FARES” etc.)

A Resource Entry is uniquely identified by a Delivery Entry with the following attributes:

- “Delivery Number”
- Resource Producer
- Resource Name
- TAP TD baseline (version)
- Valid from / Valid to (date)
- Delivery datetime stamp
- Resource status: added, removed or updated

Access Method (see chapter 7.4.2.11) In case, a Producer wishes to use another standard than B5, he has to fill in the description of the solution

A “Resource Delivery” is a unique combination of Resource Producer’s identifier, the “Resource Name” and “Delivery number”.

Illustrative example:

<i>Resource Producer</i>	<i>Resource Name</i>	<i>Delivery Number</i>
83	TIMETABLE	4-2012
83	TIMETABLE	5-2012
83	FARES	4-2012
83	RESERVATION	4-2012
87	TIMETABLE	4-2012

In the example above, Resource Producer '83' has made available two Timetable Resources numbered 4-2012 and 5-2012, a Fares Resource numbered 4-2012 and a RESERVATION Resource numbered 4-2012. Resource Producer '87' has made available a Timetable Resource numbered 4-2012

Thus, Resource Producer '83' is the owner of Deliveries 4-2012 and 5-2012 of a Timetable, and Resource Provider '87' is the owner of Delivery 4-2012 of a Timetable.

The relationship of a Resource Producer to its Resources is a composition: deletion of the Resource Producer from the Registry removes all Resources, and therefore Deliveries, associated with it. Conversely, there can be no Resource Delivery not associated with its owning Resource Producer.

A Resource Producer can add, remove, read or update a Resource as follows:

- › It can add a new Resource assumed a Resource with the same "Resource Name" and "Delivery Number" does not exist already in the Registry
- › It can update a Resource if it exists in the Registry with a specific "Resource Name" and "Delivery Number"
- › It can delete a Resource if it exists in the Registry with a specific "Resource Name" and "Delivery Number" (Deletion is logical, not physical. Deleted information should be available for Audit purposes)

7.4.2.1. *Timetable Resources*

Timetable resources are represented in the Registry as specific types of Resource entry.

A Timetable Resource entry is associated with "Timetable Services" describing either a list of Service Brands and/or a list of Service Number (train number) included in the Timetable delivery.

Timetable Resource is a description on the location where that Resource can be found with its Access Method

A Resource Producer making a Resource Delivery of timetable which specifies "Service Brand" and/or "Service Numbers" is the Information Provider for those Service Brands and/or Service Numbers.

A Partial Schedule for a "Service Number" is required to indicate that the Timetable contains a partial schedule for that "Service Number" that needs to be integrated according to the specifications of the relevant IT Specification.

7.4.2.2. *IRT Tariffs/Fares Resources*

IRT Tariffs/Fares resources are represented in the Registry as a specific type of Resource entry.

IRT Tariffs/Fares Resource is a description on the location where that Resource can be found with its Access Method

An IRT Tariff/Fare Resource is associated with a list of "Entity Codes" and/ or "IRT Tariff Codes" from the relevant Passenger Code lists.

7.4.2.3. *NRT Fares Resources*

NRT Tariffs/Fares resources are represented in the Registry as a specific type of Resource entry.

NRT Tariffs/Fares Resource is a description on the location where that Resource can be found with its Access Method

An NRT Tariffs/Fare Resource is associated with a list of "Series number" and year/month/day.

7.4.2.4. *Special Tariffs/Fares Resources*

Special Tariffs/Fares resources are represented in the Registry as a specific type of Resource entry.

A Special Tariffs/Fares Resource is a description on the location where that Resource can be found with its Access Method

Special Tariffs/Fares are not exchanged between RUs as the standard is not appropriate to RU's needs.

7.4.2.5. *Domestic Tariffs/Fares Resources*

Domestic Tariffs/Fares resources are represented in the Registry as a specific type of Resource entry.

A Domestic Tariffs/Fares Resource is a description on the location where that Resource can be found with its Access Method

7.4.2.6. *Accessibility data Resources*

Accessibility data resources are represented in the Registry as a specific type of Resource entry.

An Accessibility data resource is a description on the location where that Resource can be found with its Access Method

7.4.2.7. *Reservation Resources*

Reservation resources are represented in the Registry as a specific type of Resource entry.

Reservation Resource is an address and signature of the interface to a Reservation System in which a Resource Consumer can find a reservation (either alone or combined with the travel journey.

7.4.2.8. *Public Key Resources*

Public key resources are represented in the Registry as a specific type of Resource entry.

Public Key Resource is a description on the location where that Resource can be found with its Access Method

It contains certificates with validity and expiration dates.

7.4.2.9. *Retail Reference Data Resource*

Retail Reference Data resource is represented in the Registry as a specific type of Resource entry.

Retail Reference Data Resource is an address and signature of the interface to reference data. The RRD is an entry point where Consumers and Producers will be able to get retail reference data such as Code List, Station codes, retail specific codes.

7.4.2.10. *Data Quality Management Resources*

Data quality Management resource is represented in the Registry as a specific type of Resource entry.

Data Quality Management Resource is an address and signature of the interface to the DQM.

7.4.2.11. *Access Methods*

Access Methods represent the specification of interfaces used by Resource Consumers to gain access to "Resource Deliveries" made available by a Resource Producer, or by the Registry to send notifications to Resource Consumers about Resources they subscribed to.

Resource Access specific methods are specified by:

- A Resource Producer in a Resource Delivery
- The Registry towards the specific Resource Consumer:
 - As a default notification method for all Resources it subscribes to
 - As a specific tailor-made notification method for a specific Resource it subscribes to.

An Access Method specifies an endpoint and an indicator that authentication by the Resource Consumer is required at the endpoint (cf. Annex 12.2.).

7.4.2.12. File Transfer Access Method

A File Transfer access method is a specific Access Method with additional description pertaining to file transfer:

It can specify a list of “Resource Files” entries, each consisting of a Filename. The file access has to be implemented (e.g. HTTPS – protocol).(see Annex 2)

7.4.2.13. Web Service Access Method

A web service access method is a specific Access Method with additional description pertaining to a web services interface.

It specifies the web service endpoint, the request parameters and their types (if any restrictions apply), the response parameters and their types (if any restrictions apply). The Web Service Access Method is described in Annex 2

7.4.2.14. E-mail Access Method

An e-mail access method is a specific Access Method with additional description pertaining to an e-mail interface.

It specifies a list of e-mail addresses and optional header and footer text to be included in the e-mail.

Email is used for notification service. The email may contain the link to the URL of the TSGA central service application, but the link must not be accessible without authentication.

7.4.3. Resource Subscriptions

Resource Consumers can subscribe in the Registry to notifications about specific Resources. The notifications are sent by the Registry automatically when a Resource Delivery is added, updated or removed by a Resource Producer to all Resource Consumers that subscribe to that specific Resource, indicated by its “Resource Name”.

A Resource Consumer is associated with one or more Resource Subscriptions entries, each consisting of the “Resource Name” and, optionally a list of selected Resource Producers of that Resource.

A “Resource Subscription” is a unique combination of Resource Consumer’s identifier, the “Resource Name” and Resource Provider.

Illustrative examples

<i>Resource Consumer</i>	<i>Resource Name</i>	<i>Resource Producer</i>
83	TIMETABLE	all
83	FARES	87
DRTY	TIMETABLE	83

In the above example, the first entry specifies that Resource Consumer ‘83’ subscribes to notifications about Resource TIMETABLE from any Resource Producer, the second that it subscribes to notifications about Resource FARES delivered by Resource Producer ‘87’, and the third that Resource Consumer ‘DRTY’ subscribes to notifications about Resource TIMETABLE delivered by Resource Producer ‘83’.

The relationship of a Resource Consumer to Resources it subscribes to is a composition: deletion of the Resource Consumer from the Registry removes all “Resource Subscriptions” associated with it. Conversely, there can be no “Resource Subscriptions” not associated with its owning Resource Consumer.

The notifications from the Registry to the Resource Consumer will contain the Resource Delivery and the linked Delivery Entry (see chapter 7.4.2) of the appropriate Resource Producer.

8. Business Rules

8.1. Resource registration, subscription and access

These are the business process rules for the operation of the Registry.

These rules must be implemented in the Registry.

##	Business Rule
BR1	Resources are owned by Resource Producers who make them available under the TAP TSI Regulation.
BR2	Resource Producers can only register Resources they own or are delegated to register. A successful registration records the Resource Producer's ownership of the registered Resource (or alternatively above delegation)
BR3	Resources can only be registered by their owner Resource Producer unless the latter delegates officially the registration to another Resource Producer.
BR4	As a consequence of BR2 and BR3 above, the same Resource cannot be registered by more than one Resource Producer
BR5	If a Resource is to be registered by a different Resource Producer then the previous owner Resource Producer must first delete its registration in the Registry.
BR6	Resource Producers can restrict access to Resources they register to particular Resource Consumers, subject to the provision of the TAP TSI Regulation. In this case the Resource is a Restricted Resource.
BR7	Resource Producer can play the role of Resource Consumer when accessing Resources owned and registered by a different Resource Producer
BR8	Resource Producers are responsible for the authenticity checks to access their data repositories in Restricted Resources and maintain the access list in the system where they make Resources available: <ul style="list-style-type: none"> • Identity check • Access rights check
BR9	A Resource Consumer can subscribe to notifications about any Resource. Subscription does not grant access to the Restricted Resource, access being controlled by Access List maintained by the Resource Producer in its own system.
BR10	A Resource Consumer can access any Resource it has a right to under the Regulation, or any Restricted Resource to which the owner Resource Producer has granted access to.

BR11	Other than playing the role of a Resource Consumer to subscribe to updates and access Resources, or, possibly, Resource Producer for certain resources such as Code Lists or Reference Location Data, the TSGA may have rights under the TAP TSI Regulation and the TAP TSI Governance Process to read the Registry contents, including its logs and audit trails and reports. The TSGA will have full access to the aforementioned logs and audit trails and reports in order to monitor the fair and transparent implementation of European rail interoperability. Additional rights are subject to the TAP TSI Governance Process.
BR12	Versioning of Resources

9. Functional Requirements and Use Cases

9.1. Functional requirements

The TAP-TSI Retail Architecture is an ICT environment designed to realize the interaction between Actors as described in chapter 0, “Actors Landscape”, for the purpose of making available and accessing resources as described in chapter 7.4, “Resources”, subject to the rules described in chapter 8, “Business Rules”.

Chapters 9.1 through 9.4 document functions that must be provided by the Architecture in order for Actors to obtain results, such as “registering a resource”, or “subscribing to notifications”, that concretely implement the interactions necessary to obtain interoperability. They provide therefore a behavioural view of the Architecture.

Chapter 9.5 groups functions and allocates them to “Common Components”, i.e. structural components of the Architecture, which are a high level partition of deployable concrete implementations of the functional requirements.

Chapter 9.5.1, in particular, describes overall interoperable scenarios realized by Actors using the functions provided by the Common Components, including the coordination and communications between these components.

##	Functionality
FR1	Profile support per user with access and control mechanism, for example role, rights, standard parameters. These functions are used by the Registrar to setup the Registry for use by Actors in the landscape
FR2	The registry provides the following services to Actors: <ul style="list-style-type: none"> • Provide membership • Register a resource by creating “Resource Delivery” entries (cf chapter 9.2.2) • Update a “Resource Delivery” entry • Unregister a resource by deleting the “Resource Delivery” entry • List available “Resources Deliveries” • Read a particular Registry entry (Resource Delivery, Resource Subscription) • Subscribe to a resource by creating a Resource Subscription entry (cf chapter 9.2.3) • List current subscriptions • Logging • Audit

FR3	<p>A Registrar has the following capabilities:</p> <ul style="list-style-type: none"> • FR2 and • Create, update and delete members • Provide all necessary functions to provision an actor
FR4	<p>The registry provides the following Access Methods to services listed in FR2</p> <ul style="list-style-type: none"> • Website manual access (direct access by internet page) <ul style="list-style-type: none"> ○ User web Interface ○ Administrator's web interface • Web services call (machine access to Registry services)
FR5	<p>Registry notifies Resource Consumers that have subscribed to resources when "Resource Deliveries" have been created, deleted or changed.</p> <p>Example of possible protocols for the notification method:</p> <ul style="list-style-type: none"> • Email • Web services (a request to a Resource Consumer web service call)
FR6	<p>Each time an existing "Resource Delivery" changes or is deleted, the Registry will trigger a component that will then perform the following actions:</p> <ul style="list-style-type: none"> • Retrieve the "Resource Subscription" entries to find resource Consumers that have subscribed to the resource • Notify Resource Consumers using notification method in the Resource Subscription
FR8	<p>The Registry user web interface will use the underlying registry services listed in FR2</p> <p>The user interface is able to provide users with additional information about :</p> <ul style="list-style-type: none"> • The person to contact for each of the resource listed, in order to set up a business agreement to get access to the resource • Statistics of usage of the registry <p>The Registry user interface application shall implement access security mechanisms, managed by the Registry Administrator's user interface.</p>
FR9	<p>The Registry Administrators' user interface will use the underlying registry services in FR2</p> <p>The Administrator's web interface allows the Registrar to perform the following tasks on behalf of the TSGA</p> <ul style="list-style-type: none"> • Same tasks as an ordinary user • Perform member credential provisioning • Access logs • Generate registry activity audit trails and reports • Perform backup / restore actions • Setup and monitor security mechanisms



9.2. Use cases

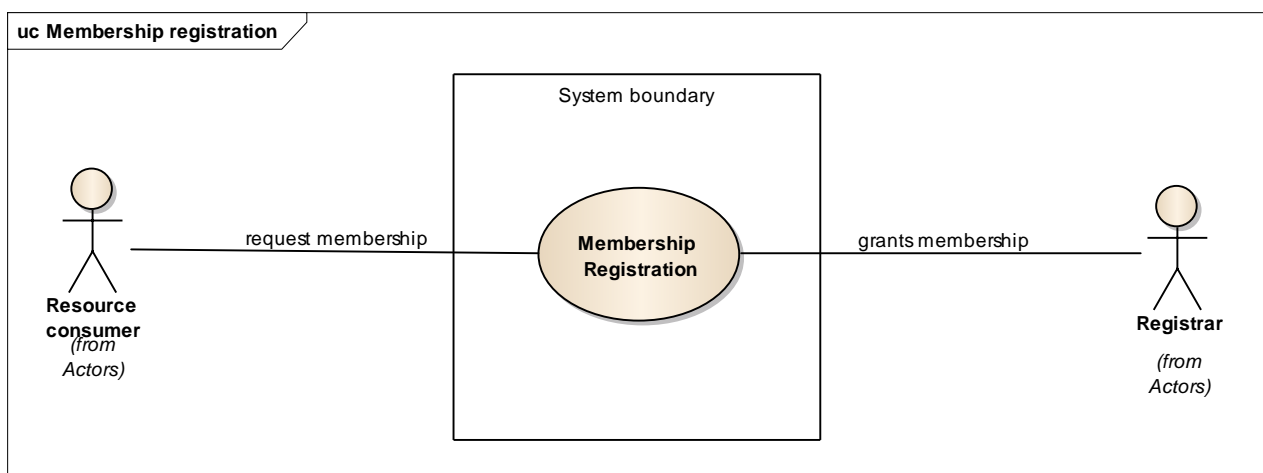
List of use cases:

- Membership Registration (CRUD)
 - Producers
 - Consumers
 - DQM
- Register a resource (CRUD)
 - Timetables
 - Tariffs/fares
 - Accessibility data
 - Certificates for ticketing
- Subscribe to a resource (CRUD)
 - Timetables
 - Tariffs/fares
 - Accessibility data
 - Certificates for ticketing
- Notify subscribers (CRUD)
- Retrieve a resource
- Submit data quality Checks

The following additional Use Cases are industry best practices and they will not be described in the reminder of this document:

- Logging
- Auditing
- Reporting
- Administrative function
- Security

9.2.1. Membership Registration



Pre-condition: Candidate member has been validated by the TSGA, and Registrar has been cleared to grant Membership

Main success scenario:

- 1 Connect to Registration website
- 2 Complete Registration form
- 3 Submit

End

Extension:

2a- Create

2b- Read

2c- Update

2d- Delete

3a – success

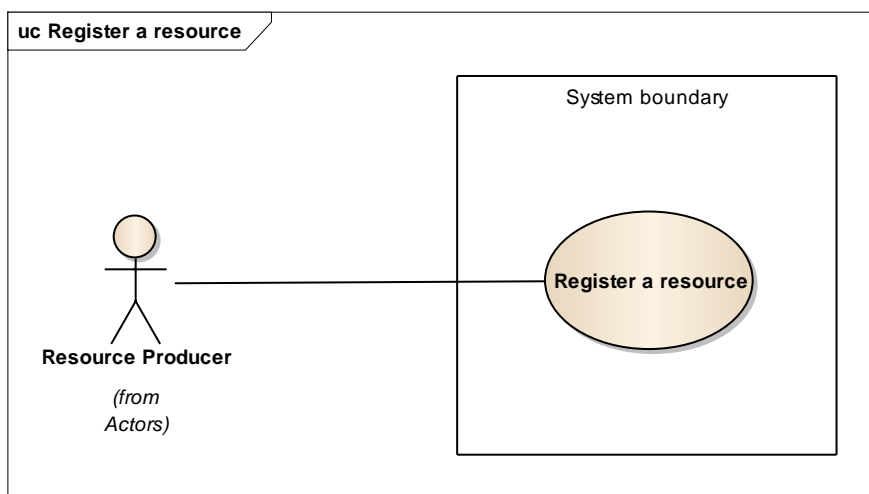
3b – failure

4a – success

4a – failure

Post Conditions: awaiting approval

9.2.2. Register a resource



A Resource Producer makes a Resource Available

Pre-condition: - actor is a registered user

- Resource has passed Data Quality Management checks (whatever tool is used)

Main success scenario:

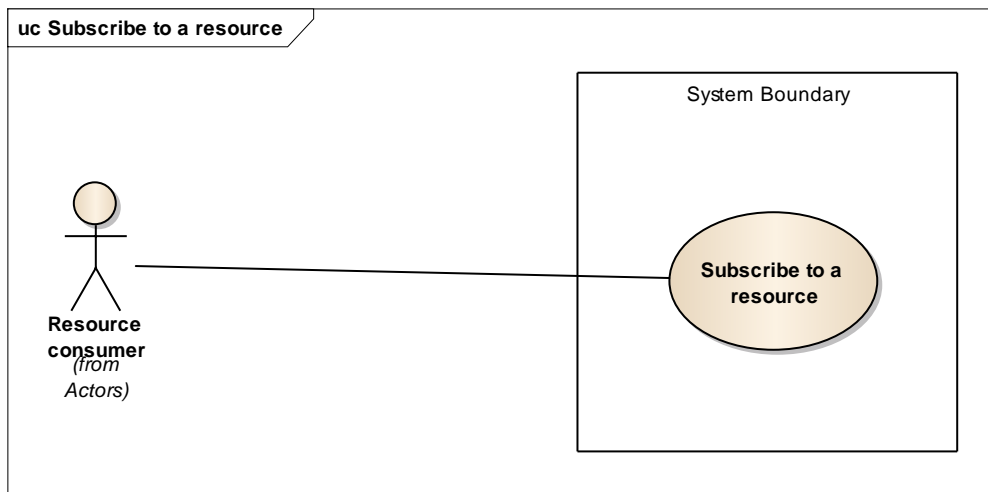
- 1 Resource Producer provides identification credentials to the Registry
- 2 Resource Producer creates Resource Delivery entry in the Registry

End

Extensions: ref Chapter 8 Business Rules

NOTE: Step 2 Use Case can be performed by Resource Producer Human operators using Registry User Interface

9.2.3. *Subscribe to a resource*



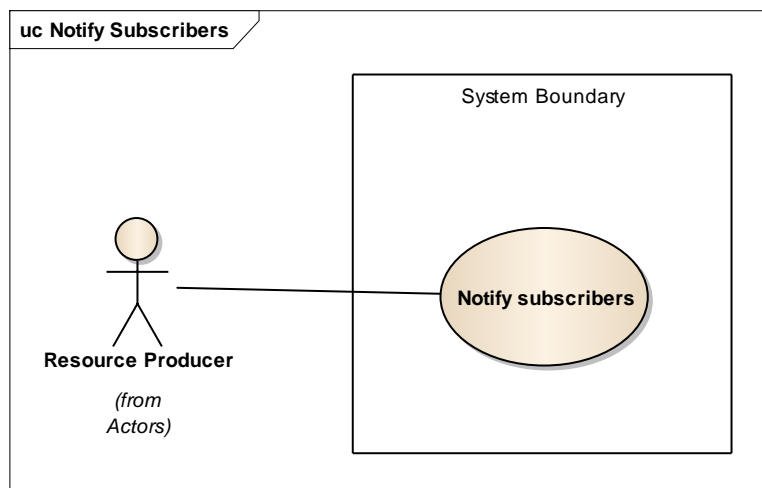
Pre-condition: - actor is a registered user
- The resource has been registered

Main Success Scenario

- 1 Resource Consumer Provides identification credentials to the Registry
- 2 Resource Consumer creates Resource Subscription entry in the Registry

End

9.2.4. *Notify subscribers*



Upon reception of an Update Signal on a Resource, send notification messages to Resource Consumers subscribing to Resource

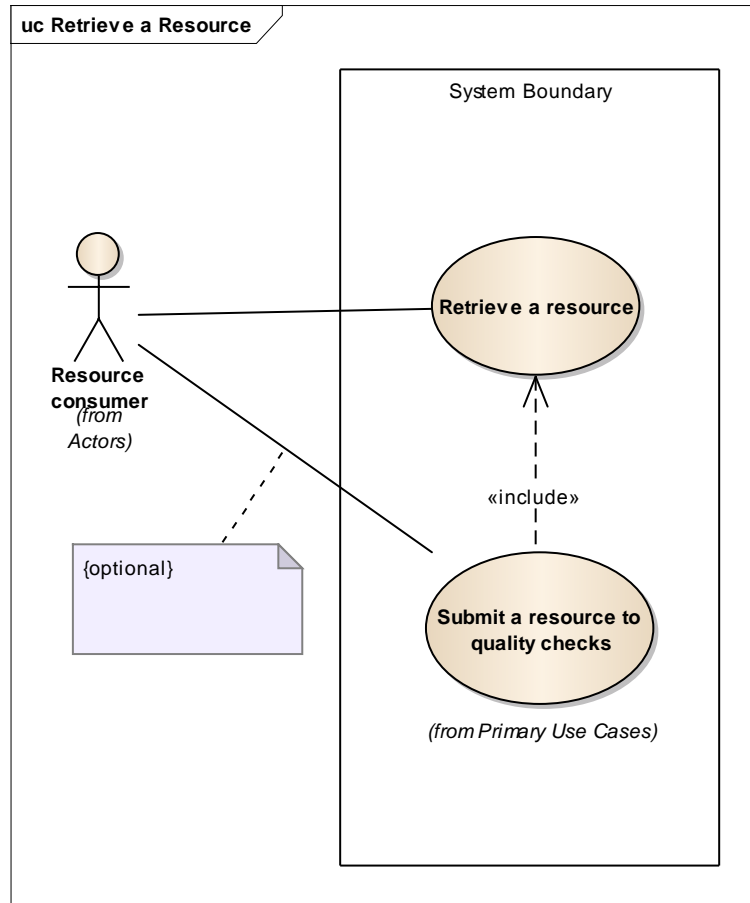
Precondition: Notifier receives signal from the Registry

Main Success Scenario

- 1 Notifier retrieves “Resource Subscription” entries from Registry
- 2 Notifier reads Resource Consumers and Notification methods from Resources Subscription entries
- 3 Notifier sends notifications to Resource Consumers using notification methods

End

9.2.5. Retrieve a resource



A Resource Consumer retrieves a Resource made available by a Resource Producer

Preconditions: Resource Consumer has credentials to access Resource as specified by Resource Producer on Access method's interface

Success Guarantee: Resource Consumer successfully retrieves Resource

Main Success scenario

- 1 Resource Consumer gets "Resource Delivery" entry from Registry to obtain Resource information and Access Method to the Resource
- 2 Resource Consumer uses Access Method to determine location and interface to Resource
- 3 Resource Consumer submit request of Resource using specified Interface
- 4 Resource Consumer stores Resource
- 5 Resource Consumer may optionally execute "Submit Resource to Quality Checks"

End

NOTE: Steps 1, 2 and 3 of Use Case can be performed by Resource Consumer Human operators using Registry web User Interface

9.3. Data Quality Management

9.3.1. Functional Requirements

Functional Requirements listed in chapter 9.1 describe functions that must be available to Actors to realize interoperable exchange of Resources. In the interest of *effective* interoperability, however, the TAP-TSI Retail Architecture must provide functions to check that Resources exchanged meet certain quality standards in terms of the data content and consistency, as described in this chapter. Data Quality Management functions are allocated to a “Data Quality Management” (or DQM tool) component.

##	Functionality
DR1	<p>The Data Quality Management (DQM) tool will be able to access the following reference data in order to perform data quality checks:</p> <ul style="list-style-type: none"> • Reference Location Data • Code Lists • Retail Reference Data (RRD)
DR2	<p>Data Quality Management checks vary depending on the Resource whose quality is requested to be checked (e.g. Timetables, Fares).</p> <p>The checks will be done according to the mandatory data quality chapters of the individual TAP TSI implementation guidelines.</p>
DR3	<p>The DQM tool will carry out the following activities:</p> <ul style="list-style-type: none"> • Perform quality check on a resource • Produce a report on the resource • Produce audit logs • Produce standard and ad hoc reports
DR4	<p>The Data Quality Management component provides the following interfaces to its services:</p> <ul style="list-style-type: none"> • Website manual access (direct access by internet page) • Web services call
DR5	<p>The DQM user web interface uses the underlying DQM services</p> <p>The user interface allows the users to perform the following tasks:</p> <ul style="list-style-type: none"> • Log in • submit a resource for data quality checking • Save the report of the quality checks • receive the report on the quality check process • notify the requester that the data quality checks have been completed • View historic reports <p>The DQM user interface application shall implement access security mechanisms, managed by the DQM Administrator's user interface.</p>

The user interface is able to provide users with additional information about:

- The person to contact regarding the service
- Statistics of usage of the DQM

DR6 The DQM Administrators' user interface uses the underlying DQM services

The DQM Administrator's interface allows the DQM administrator on behalf of the TSGA to perform the following tasks:

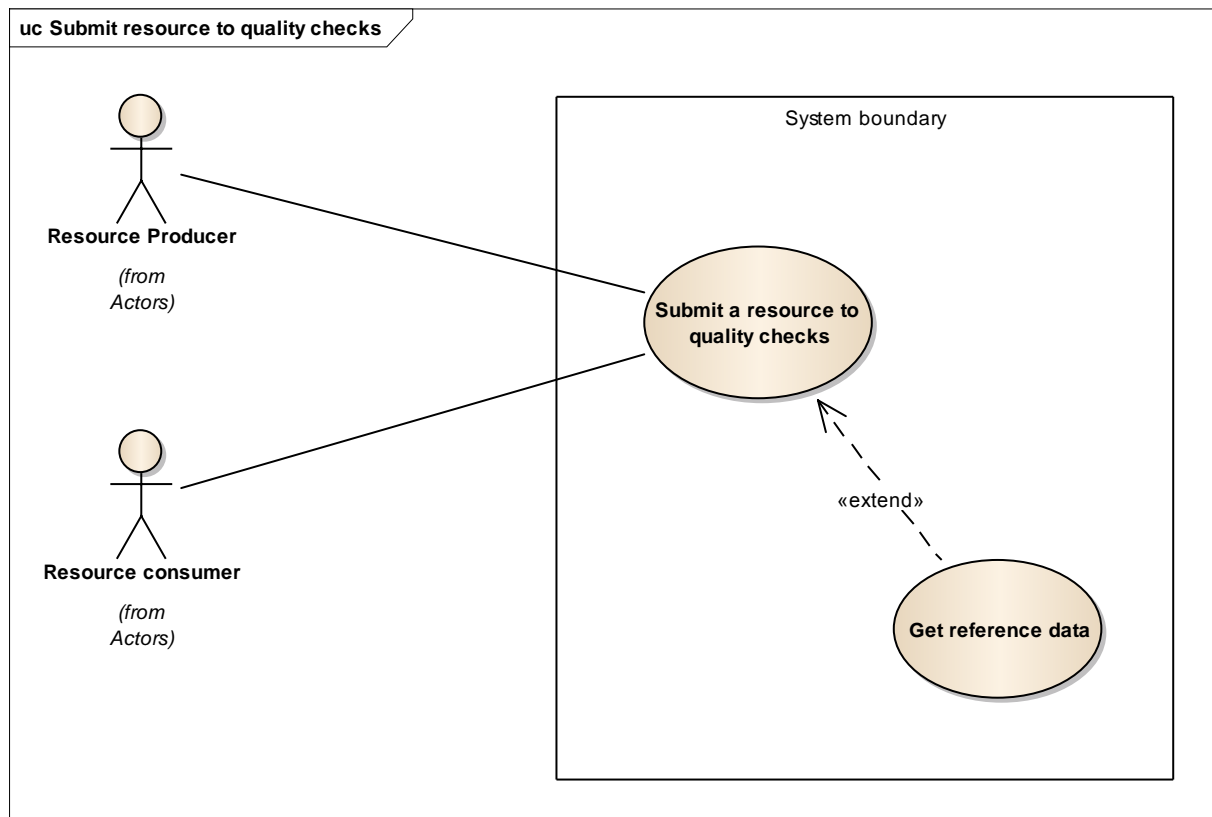
- Same tasks as an ordinary user
- Perform user credential provisioning.
- Access and store logs
- Generate DQM activity audit trails and reports
- Perform backup / restore actions

9.3.2. Use cases

List of use cases:

- Submit a resource (through machine or user interface)
 - Timetables
 - Tariffs/fares
- The following additional Use Cases are industry best practices and they will not be described in the remainder of this document:
 - Logging
 - Auditing
 - Reporting
 - Administrative function
 - Security

9.3.2.1. Submit resource to quality checks



Precondition: actor is a registered user

Main Success scenario:

- 1 Resource Producers or Consumers retrieve data Management Tool address from Registry (could be done only once)
- 2 Resource Producers or Consumers provides credentials to DQM tool
- 3 Resource Producers or Consumers submit the resource
- 4 DQM checks the content of the submitted resource against Reference Data stored in the Retail Reference Data
- 5 Resource Producers or Consumers get report on the resource (synchronously or asynchronously depending on the solution)

Extension:

- 4.1 execute Get Reference Data Use Case (see chapter 9.4.2.1)

End

9.4. Retail Reference Data

The Retail Reference Data provides a single access channel to multiple primary reference data sources insulating Actors from the actual storage location and managing on behalf of the Actor the access credentials to these sources.

Retail Reference Data includes:

- › Reference Location data (TAF-TAP CRD)
- › Retail reference data (TAP TSI RRD)
- › Code lists
- › Retail specific data

9.4.1. Functional Requirements

##	Functionality
DR1	<ul style="list-style-type: none"> TSGA will provide credentials to RRD so that it can access to the primary reference data sources.
DR2	<ul style="list-style-type: none"> Only Authorised users can access RRD
DR3	<p>RRD provides a User interface for accessing the Retail Reference data via various access methods described in the annex, e.gl.:</p> <ul style="list-style-type: none"> Downloading from a website Using File transport Protocol Web services :
DR4	<p>The user interface also provides an administration console for the TSGA to handle the provisioning of user credentials.</p>

9.4.2. Use cases

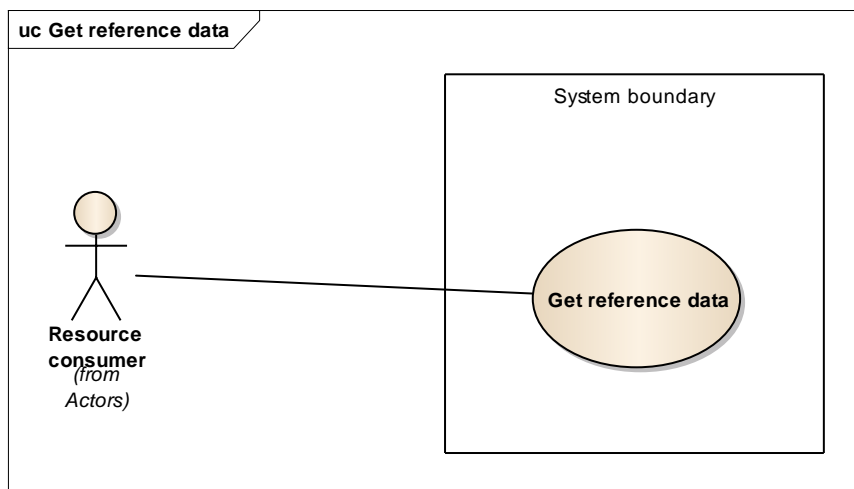
List of use cases

- Get reference data

The following additional Use Cases are industry best practices and they will not be described in the reminder of this document:

- Logging
- Auditing
- Reporting
- Administrative function
- Security

9.4.2.1. Get reference data



Precondition: actor is a registered user

Main success scenario:

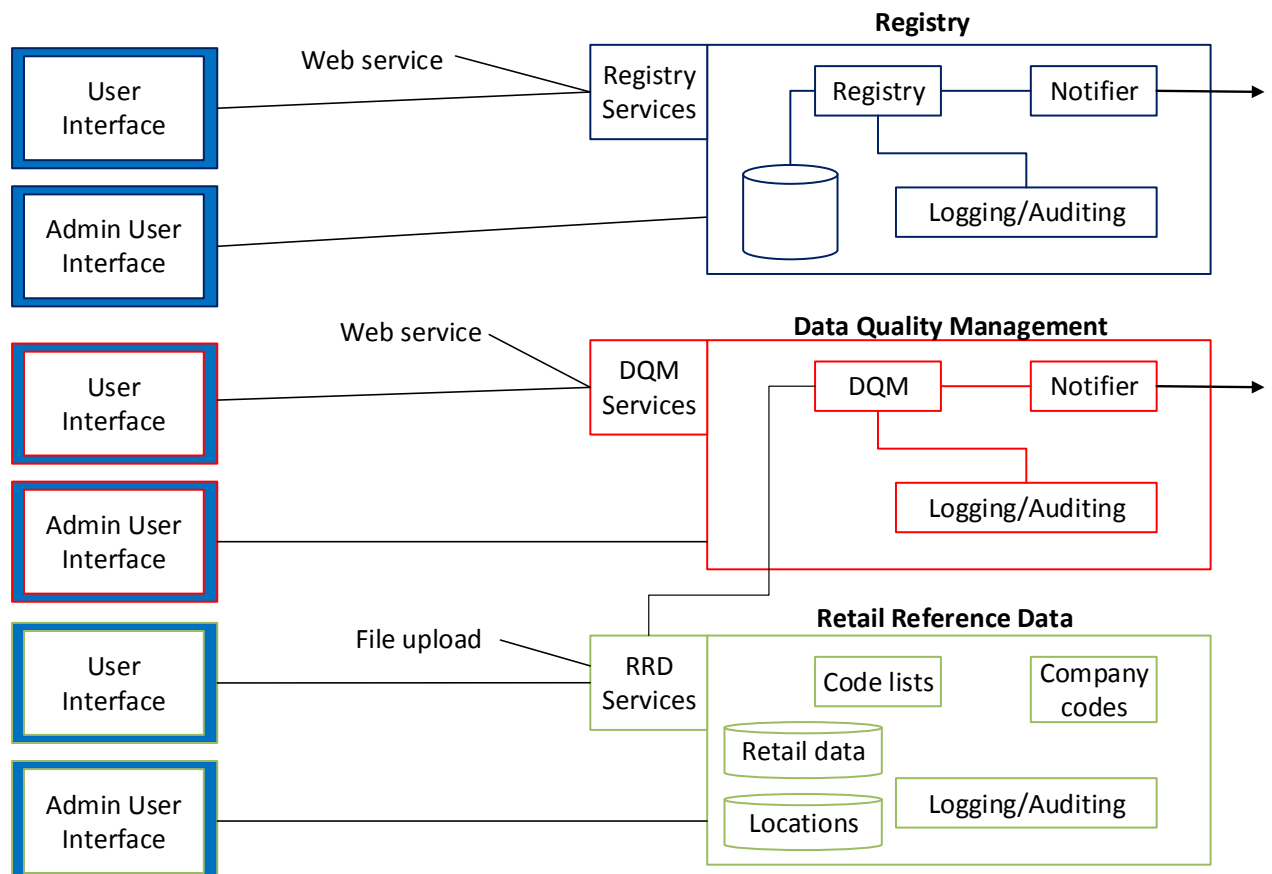
- 1 Resource Producer or Resource Consumer provide credentials to RRD
 - 2 Resource Producer or Resource Consumer identify the type of reference data
 - 3 Resource Producer or Resource Consumer submit
 - 4 Reference data is returned to Resource Producer or Resource Consumer
- End

NOTE: Use case can be executed as extension of Submit Resource to Quality Checks Use case (see chapter 9.3.2.1) by Data Quality Management Tool.

9.5. Common Components of the TAP-TSI Retail Architecture and their interaction

The functional requirements described in chapters 9.1 through 9.4 are implemented by three structural, or “Common Components” of the TAP-TSI Retail Architecture described below.

The Common Components are deployable units providing logically coherent services, loosely coupled by service consumer/producer relationships, and each support a User and an Administrator’s interface for Human operators, including the Registrar.



The three common components of the TAP TSI retail architecture are:

- **TAP TSI Registry for Interoperability.** It provides:
 - Registry services
 - Notification services
 - Log/Audit services
 - User Interface

- **Data quality management (DQM).** It provides:
 - DQM services
 - Notification Services
 - Log/Audit services
 - User Interface

- **Retail Reference Data (RRD).** It provides:
 - Central Reference Data services

- Code List
- Retail data
- TAP TSI-TAF TSI common reference data
- User Interface
- Log/Audit services

Retail Reference Database (RRD) is a database where the actors can find reference data specific to retail that cannot be found in the location Common Repository Domain of TAF (further details will be known at time of preparing the tender). The RRD is the interface the Actors needs to log in to be able to access different kinds of reference data (Code list, station Locations, specific retail locations data, company codes).

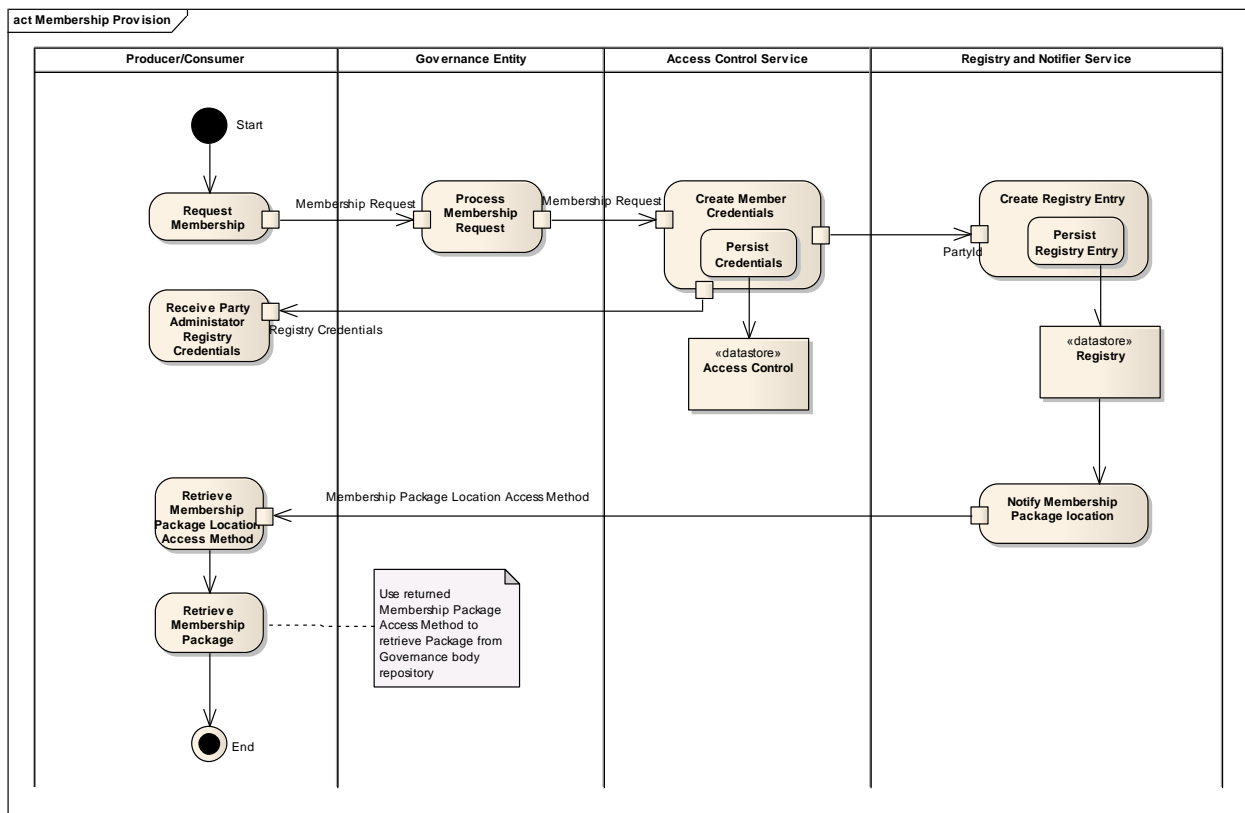
9.5.1. Overall interaction

9.5.1.1. Actors ask for membership in the Registry

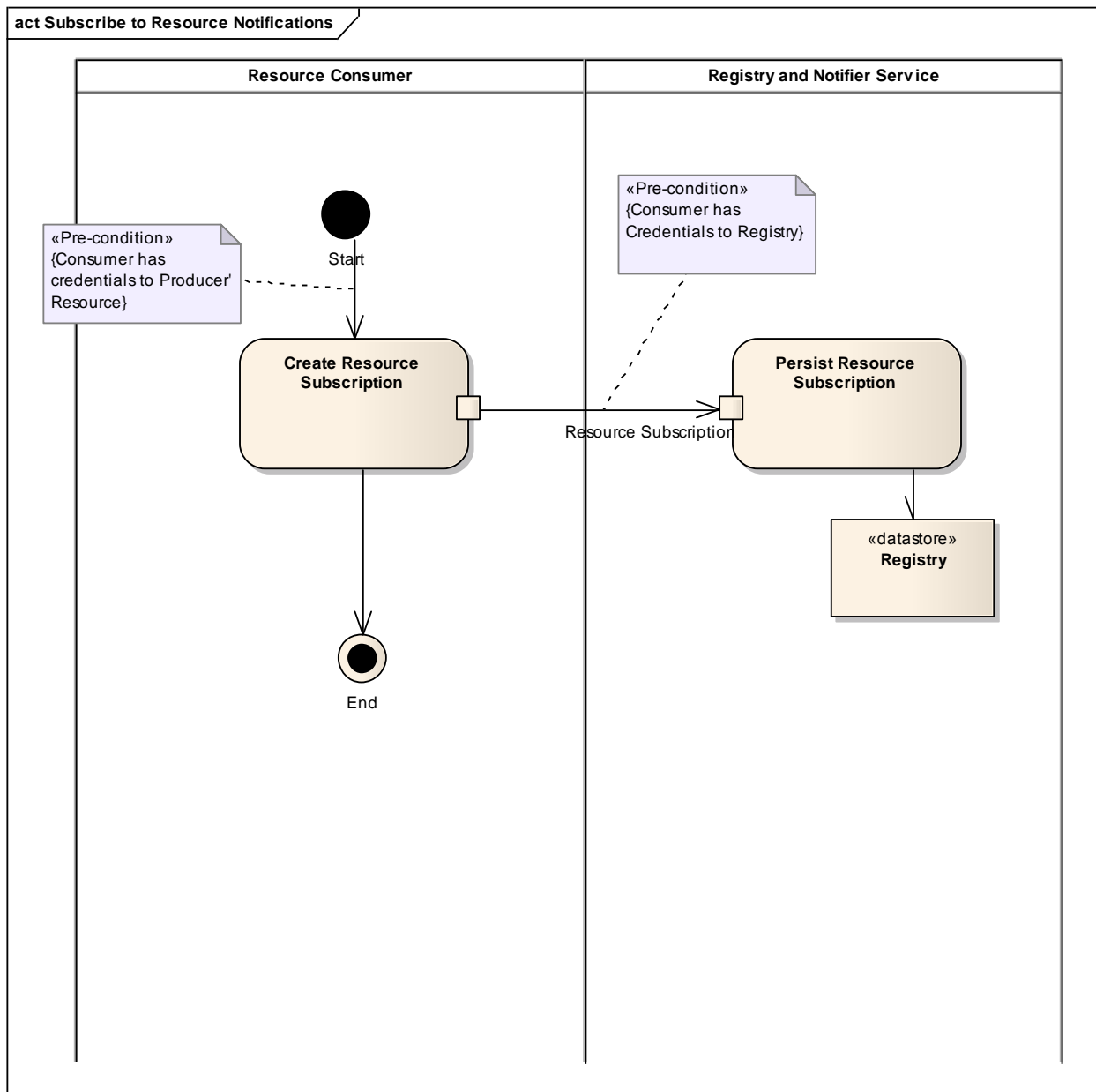
- 1- Producer or Consumer contact TSGA to get membership
 - a- P or C are informed of all pre-requisite to be member of the TAP TSI community
 - b- P or C give commercial contact details in order to be contacted by Consumers
- 2- G acknowledges the registration to P or C (if pre-conditions are fulfilled)
 - a- gives credentials details for the Registry (same login for Registry, DQM and RRD)

9.5.1.2. Actors request information from the Registry

- 1- **Actor** accesses the Registry to request one of the following info:
 - a- Address where the DQM is located and related user guide
 - b- Address where the Retail Reference Data is located
 - c- Address where all official documents are situated (ERA web site)
 - d- Address where all TAP documentation is located
 - Technical Documents
 - Retail Implementation Guides
 - Possible Access Methods



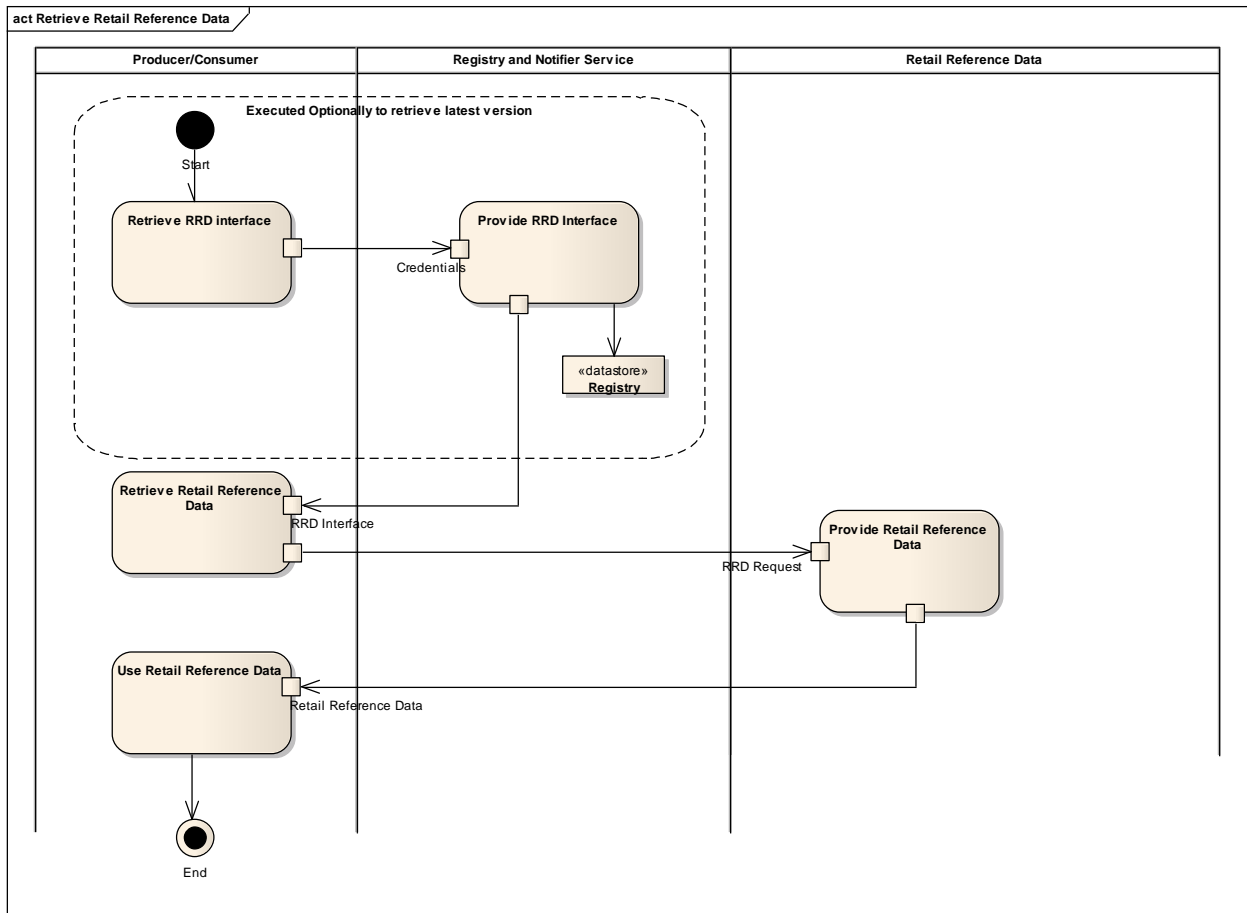
2- Actor receives the requested info.



9.5.1.3. Actors get reference data from the RRD

Producers and Consumers get the Locations, Company codes and retail data from the RRD.

- 1- All actors can request the reference data needed to exercise their rights or fulfill their obligations from the RRD, an interface able to access different types of reference data.
 - a. They can request location code (both station codes used in common by TAF or the retail specific codes) where applicable (e.g. the RRD locations with the type "bus station" will not be common by TAF).
 - b. They can request Company codes and Country codes
- 2- Actors receive the requested info



9.5.1.4. *Actors check quality of Resources (Timetables and Tariffs/Fares)*

Producers need to make available resources with the TAP expected quality.

The DQM tool is here to help producers to get insurance of the right quality and to help Consumers to have the insurance the data is of expected quality. This tool is available to any Producer or Consumer who wishes to use it.

Timetables data are checked with a tool, Tariffs/Fares with another one.

Consumers can use the DQM provided they didn't alter the original data they got from the Producer.

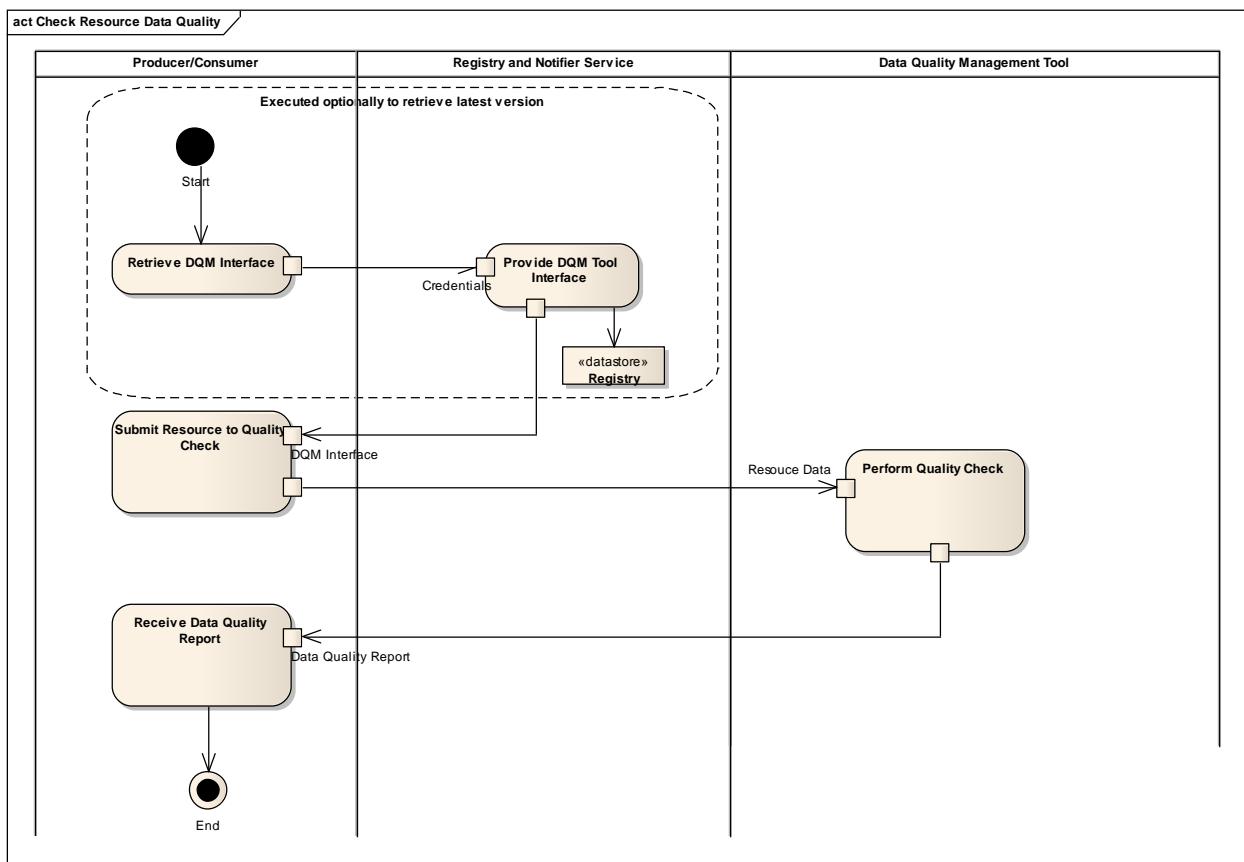
- 1- Producers or Consumers need to send the complete set of data to the DQM
- 2- The DQM checks rules but also ensures Data are in line with the data in the RRD
- 3- The DQM sends back a report.

If the DQM Report shows errors, then the Producer needs to correct them and re-send the whole set. In case the Consumer receives a report with errors, he can contact the concerned Producer and alert him of this situation.

If the DQM Report shows warnings, the Producer will decide whether it's normal or not. If not, corrections should be brought and the whole set of data should be re-submitted, and this until the Producer decides the quality is correct.

Consumers may use the DQM to ensure the quality of data they got from a Producer.

The DQM perform syntax and logical checks that are listed in the appropriate Implementation Guides.

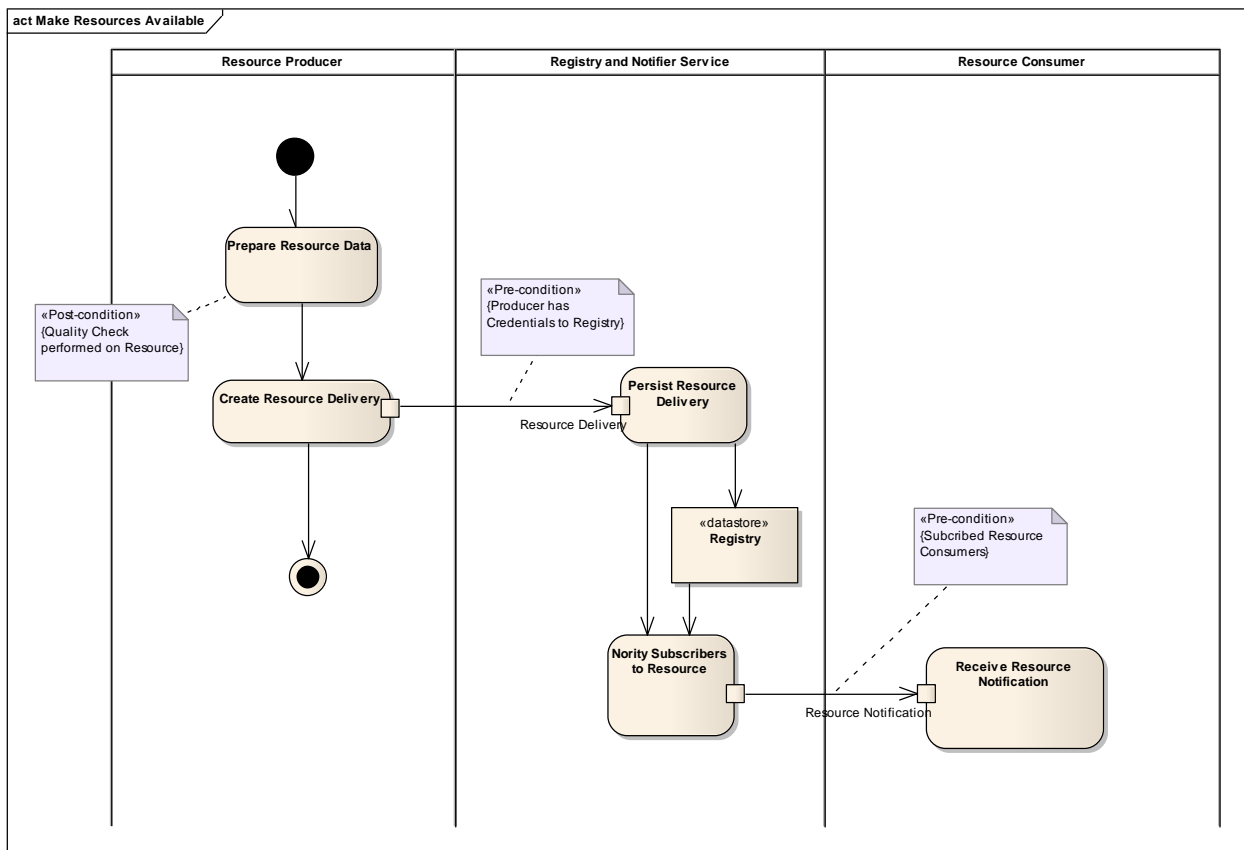


9.5.1.5. Producers make available their resources on a data server

Once data quality is ensured, either by using the DQM or by another means, Producers makes their Resources available on the chosen data server.

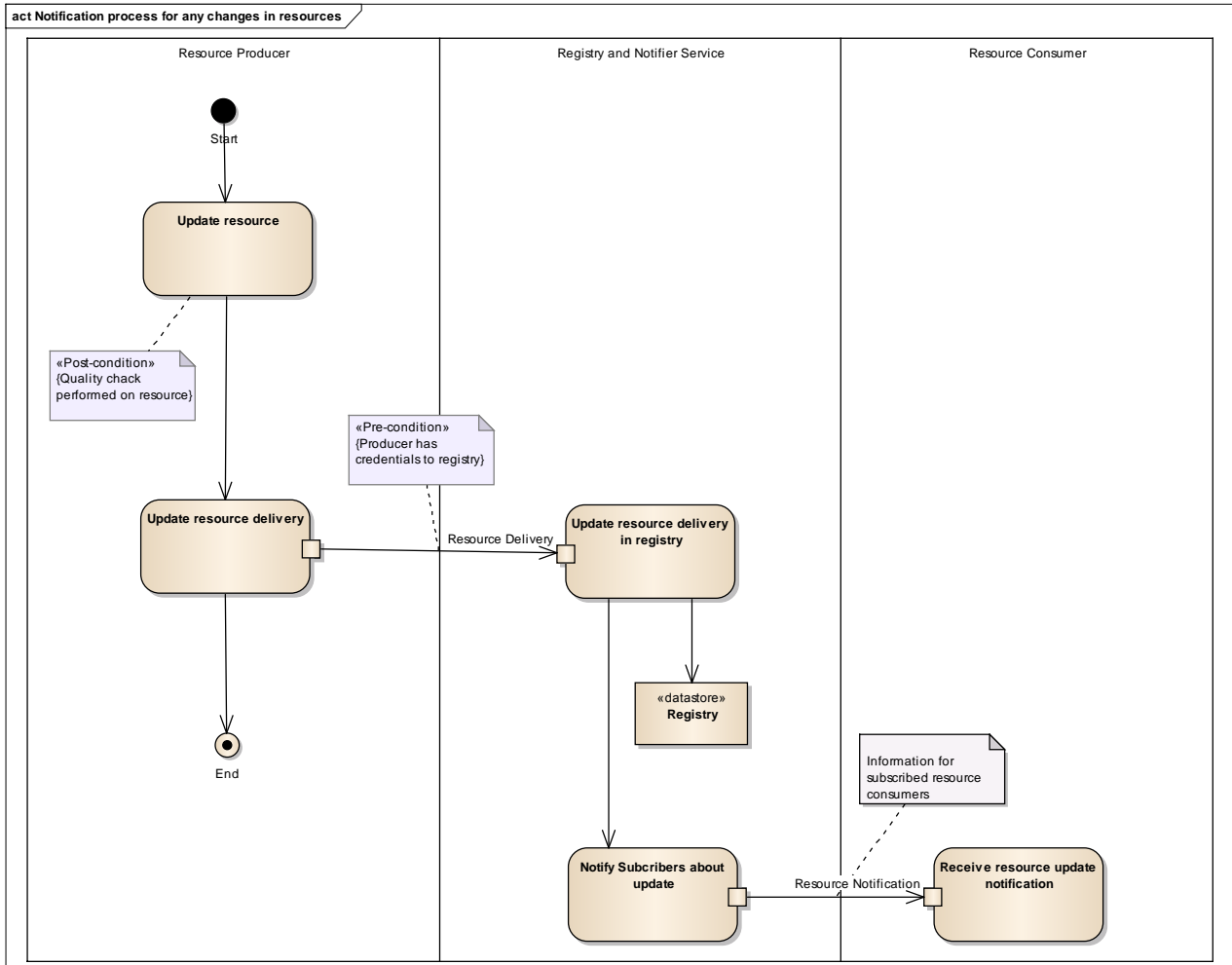
In the drawing below, Producer A (RU A) has chosen to build its own data server and put its resources here.

Producer B (RU B) has chosen to use a third party owned date server where several other Producers may have their resources as well with a specific address. Regardless of the option A or B, the data has to be sent to the central registry in order to be shared with the Consumers / Subscribers.



9.5.1.6. Notification process for any changes in resources

Once a Producer is ready to make available a Resource, it registers it to the Registry.
Registry initiates the notification process by retrieving Resource Subscriptions
Registry notifies subscribed Resource Consumers.



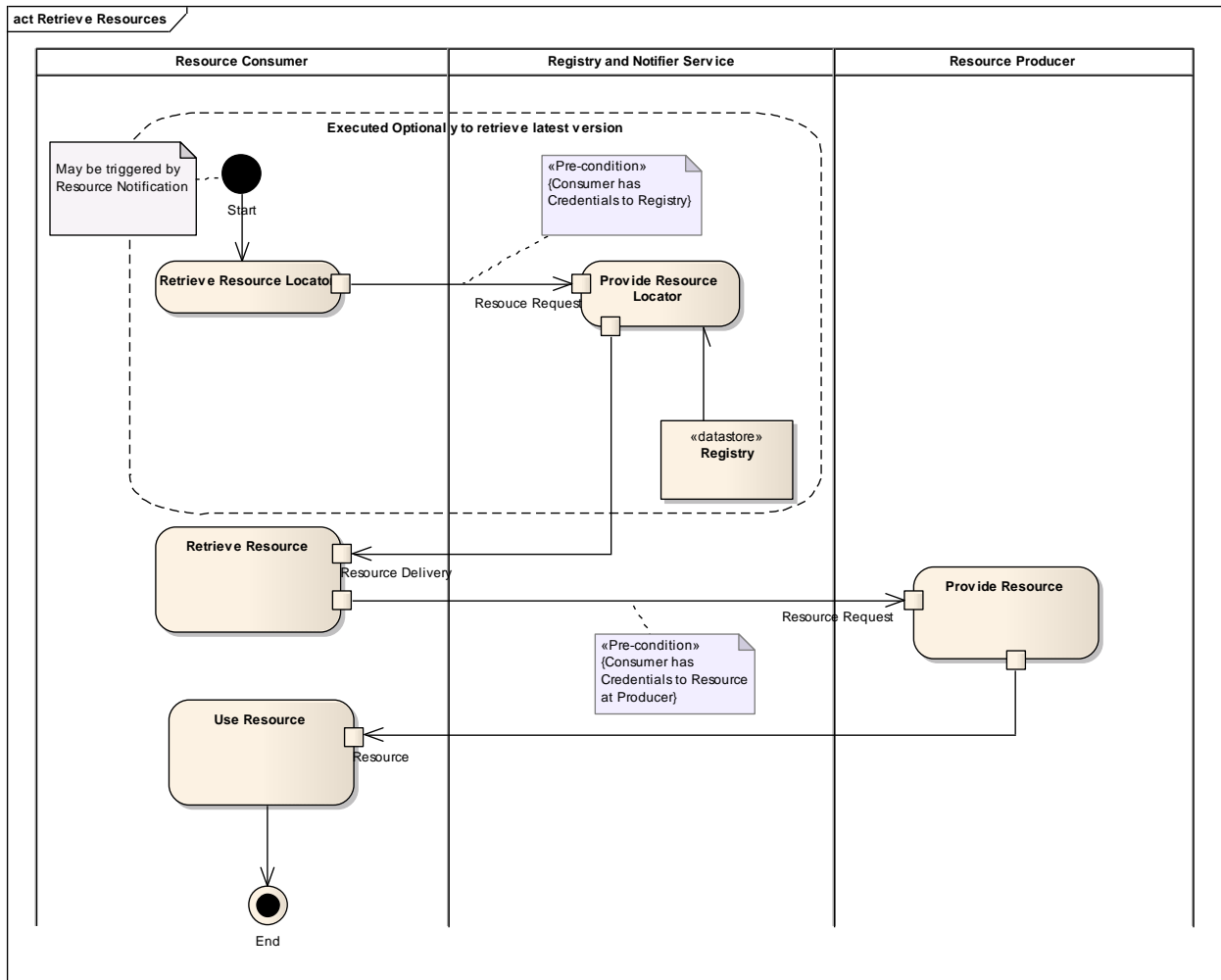
9.5.1.7. Consumers get Resources from Producers at the appropriate locations

Once notified, Consumers go and get the new Resource (the complete set) at the right place.

1- Consumer goes to the concerned system (thanks to the location he obtained from the Registry) to request the type of resource he wished to get

- a- he identifies himself (security access controlled by the Producer)
- b- he uses the access methods requested by the Producer

2- Consumer download the requested resource



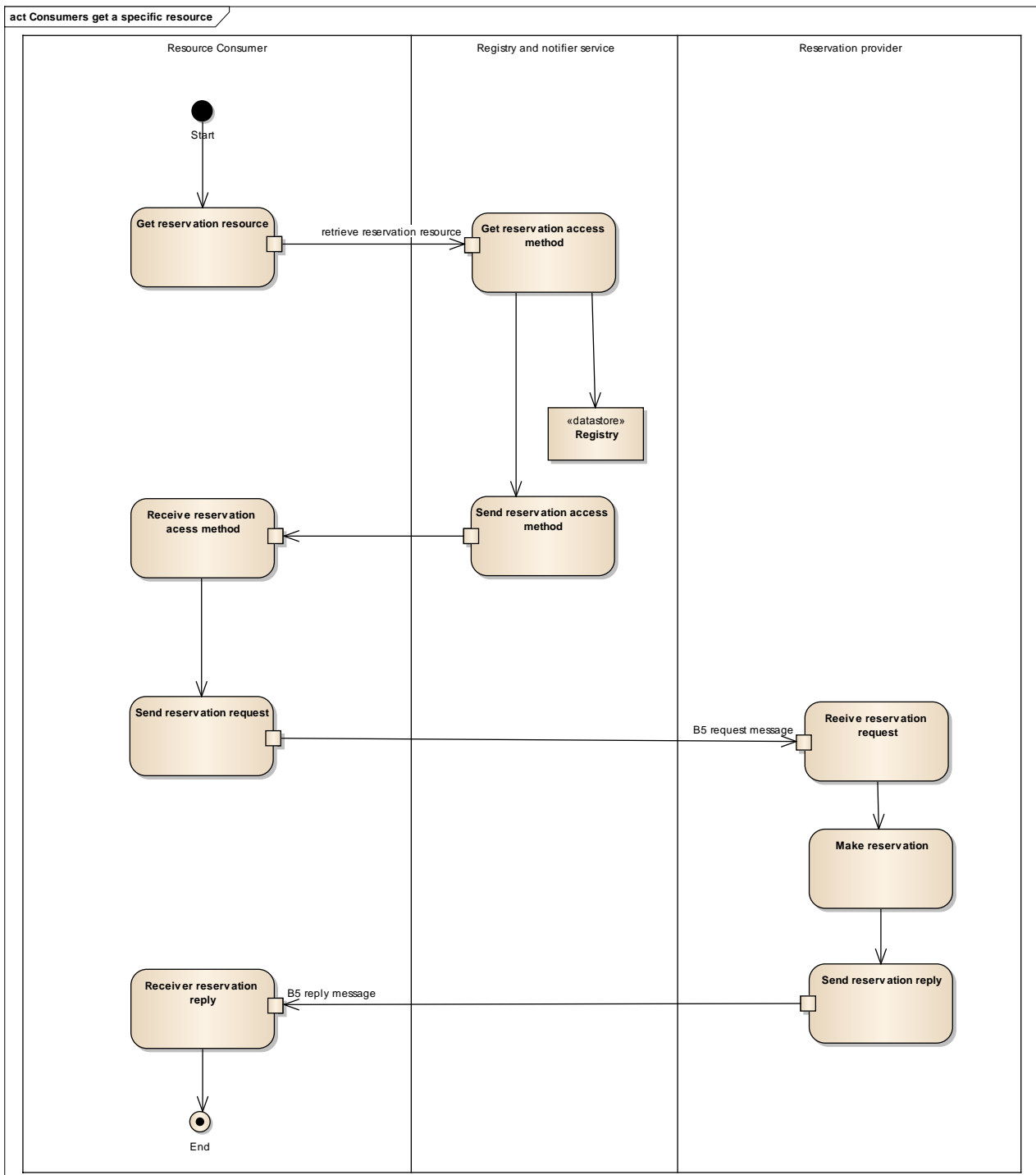
9.5.1.8. Consumers get a specific resource (Reservation and IRTs) via an interactive interface at an appropriate reservation system

Consumers can get IRTs or “Reservations only” by sending a message to the appropriate reservation systems, having previously located the address and interface of the target Reservation System in the Registry. For NRTs, as they represent open ticket, there is no need of reservation and sales are made within each own system thanks to the download done of that type of resource (see 9.5.2.7)).

That specific Resource does not need to go through a quality checker, it is assumed the quality is right. There is no notification for the update of that Resource

With such an interactive process through a specific protocol, Consumers are able to get a reservation on a designated train.

Architecture will not define a specific protocol to exchange reservation even though it is needed. Actors need to agree between themselves in bilateral agreements the protocol they will use and they can register the protocol in the Registry



9.5.1.9. Printing ticket

Printing a ticket is the next step.

Using RCT2 ticketing solution does not require any specific architecture, the format is described in TD B.11

Using the Print@home solution based on the Digital Signed Ticket security mechanism needs the Distributor to make available its certificate to the Ticket Control Organisation (TCO) which will controls valid ticket onboard trains. The TCO is acting as a consumer and gets the Resource ticketing certificate from the Producer (the distributor). This case is covered by Chapter 9.5.1.7 "Get Producer Resources"

10. Non Functional Requirements for the TAP retail architecture

This chapter describes additional non-behavioural qualities of the TAP-TSI Retail Architecture implementation that are required to meet the provisions of the TAP Regulation in the actual operational Passenger interoperability environment, and to provide actionable governance operations to the Governance Body.

These requirements do not affect Functional requirements as described in chapters 9.1 through 9.4, or the structural composition in chapter 9.5, but they provide inputs in the selection of technologies, deployment options and infrastructure for implementation.

10.1. Conditions for Access to the Registry

##	Condition for Access
AR1	The Registry must be accessible in a secure manner.
AR2	The Registry will be available in English only
AR3	Access to the Registry for all users will be either through the internet or a private network.
AR4	Each user of the Registry will be responsible for making their own arrangements for access via the internet or a private network. The Registry extends only to the access point located at the Registrar's hosting location.
AR5	The Registry shall be accessible 24 hours a day, 7 days a week, except if precluded by maintenance performed outside peak periods, or technical or security problems. Advance notice of any interruption in access, and expected resumption of service, shall, to the maximum practical extent, be provided via the website

10.2. Quality of Service requirements

##	Requirement
NFR1	The Service Desk and Operational support is delivered broadly in accordance with a Service Management model (using agreed process and agreed communication method)
NFR2	The Registry , the Data Quality Management Tool and the Central Reference Data components of the TAP TSI Retail Architecture will be deployed on a high availability and scalable industry standard infrastructure, not requiring specialised hardware or components. The design must be an independent of architecture, allowing choice to data centre providers for multiple strategies to achieve high performance and availability, including load balancing, provision of synchronised mirror sites, data centre virtualisation, cloud computing, etc., deployment.
NFR3	Documentation shall include, as a minimum: <ol style="list-style-type: none"> 1. Software Architecture Model 2. Use Case model 3. Domain Model

4. Service and Programming Model
5. Deployment Model
6. User Documentation and Manuals

All documentation must be in English,

NFR4 The Registry user interface, Registry Administrator's user interface, Data Quality Manager user interface, Data Quality Manager Administrators user interface should all be web based

NFR5 Registration Services, Subscription Services, Get Registry Entry Services, Registry Log/Audit services, Data Quality Management services, Data Quality Manager Log/Audit services and Central Reference Data services shall be protected against the IT security threads. For this purpose the TSGA shall establish an IT security documentation.

All services will implement non-repudiation security mechanisms

All ports will be strictly accessible only by the dedicated service and secured protocol.

For the vulnerability prevention purposes, , only the port 443 (https) should be externally available for the services. The services available over this port are:

- Web site (user interface for web application for Registry services, Registry administration, Data Quality Management)
- API (Application programming interface) for web service calls
- Upload of files for inventory and Data Quality Management
- Download of files

NFR6 .
All Registry activity, including Registry Services and/or Registry User Interface security events, shall be logged at the TAP TSI Actor / Resource / Access Method level, whether initiated by remote computer or the User Interface applications, including notifications generated by the component in charge of notification to subscribed Resource Consumers.

Logs shall include signature of requestor, including credentials, and timestamp.

NFR7 Mechanisms shall be implemented to create full and incremental backups of the entire contents of the Registry, including logs, configuration files and user credentials, and for restoring the entire Registry to a specified consistent state

10.3. Volume of Exchanges

Figures should be considered as indication

Number of calls	Average: 6200 to 16100 / day (10 * total amount of stakeholders)
Data volume per call	depends on the message formats specified in the registry solution
Access right and confidentiality	Authorised producers and consumers

10.4. Service capacity

Figures should be considered as indication

Availability	99.8% minimum availability
Response / execution time	5secs max response time (best effort)
Integrity and security	Access authentication SSL security
Limits	Maximum of 10 max concurrent calls for all stakeholders

10.5. Support level

Figures should be considered as indication

Support level	One: Basic support: restarting software application, network error, hardware malfunction...365 7/7 Two: Functional support: non working flow, halted software process... Three: Advanced support: fixing data, bugs, ... Working days / office hours 9-18
Availability	Per annum and then per diem Example : 365 7/7
Maximum reaction time	2 hours
Maximum resolution time	24 hours

11. Obligations of the Registry Service Provider

11.1. Definitions

(a) “Approval” means either:	(i) an electronic approval, by the Registrar, of an entity as a registry user entity and/or of an individual as that registry user entity’s administrator
or:	

	(ii) an electronic approval, by the administrator, of an individual as a registry user of such registry user entity, and “approve” and “approved” shall be construed accordingly.
(b)“Confirmation” means	an electronic confirmation, automatically issued by the Registrar when a registration, amendment or discharge is searchable.
(c)“Website” means	the website that provides the public interface of the International Registry and associated content provided by the Registrar under the Uniform Resource Locator (URL): http://www . (e.g. https://service.tsga.eu)
(d)“Registrar” means	that person appointed by the TSGA to supervise the working of the International Registry

The registry service and its administrator must take reasonable care and a minimum set of formal checks to assure the integrity of the Register. This equally applies to all registry entry administrators.

The Secure Socket Layer must be used for accessing the services (for reading or for updating purposes). The access is provided only to registered partners and consumers. The access must be controlled and logged for auditing purposes.

11.1.1. Sign-up and Approval – Registry User Entity and Administrator

1 The administrator of a proposed registry user entity shall complete and electronically submit to the Registrar the form for approval of:

- (a) a registry user entity; and
- (b) an administrator of that entity.

Information designated as mandatory on the form shall be provided. Information designated as optional on the form may be provided. Names of organisations and persons must be their correct legal names. In exceptional cases (e.g. where the space on the form is insufficient), prior approval of the Registrar is needed for using a name other than the correct legal name must be sought by email. A proposed registry user entity shall also electronically submit to the Registrar, with proper signature, confirmation that a proposed administrator is entitled to act in that capacity. At the specific request of the Registrar, such confirmation shall be provided in hardcopy on the entity’s letterhead with proper signature. All applications for approval shall include acceptance of these Procedures and of the website terms and conditions governing the use of the International Registry.

2 All applications for approvals will be acknowledged to the electronic mail address provided on the submitted application form.

3 The proposed administrator shall promptly reply to requests for additional information from the Registrar in connection with the approval process. Such requests, made at the sole discretion of the Registrar, shall be consistent with applicable privacy laws.

4 After above information has been provided, the Registrar shall issue to the proposed administrator, in electronic form, the Registrar’s approval and a notification of the URL at which the administrator can access his/her digital certificate, together with appropriate instructions on its use.

5 The Registrar shall issue its approval (if given) as soon as is reasonably practicable and will complete the approval process within 48 hours of receipt of the application.

6 Once the Registrar has issued its approval, the administrator shall test his/her ability to access the website.

7 The Registrar shall not approve a registry user entity or an administrator where the Registrar believes that the requirements quality and care have not been met. In such a case, the Registrar, if requested in writing shall:

- (a) specify in writing or via email, the reasons why such requirements have not been met; and
- (b) provide the applicant with a reasonable opportunity to take corrective action.

If not corrected, at the sole discretion of the Registrar, the application shall be declined. Refusal of an application shall not prevent an applicant from making a subsequent application for approval, provided that the requirements of these Procedures are fully complied with in respect thereto, and payment of the appropriate fee for this subsequent application together with VAT (if applicable) is made.

8 The fee for issuing a replacement digital certificate shall be borne by the registry user entity. A person seeking a replacement digital certificate shall apply to the Registrar and follow the instructions specified on the website.

9. The Registrar may revoke the approval of a registry user entity and/or an administrator at any time where, in its view, there exists a material risk of fraudulent registrations or other misuse. In such a case, the Registrar and the registry user entity shall take all reasonable steps to cooperate to expeditiously take corrective action appropriate under the circumstances; the back-up contact may be used as required. In this case the Registrar may block and/or disable the user account of the registry user entity concerned.

11.2. Sign-up and Approval – Registry User

1 A proposed registry user seeking to act on behalf of an approved registry user entity shall apply through the website, requesting electronic approval from the administrator of that entity.

2 An administrator has the sole right to approve one or more registry users employed by a registry user entity to act on his/her behalf. If the administrator elects to approve such registry users, the administrator shall take that action through the “approved registry user” page on the website, specifying the period of validity of a proposed registry user’s access to the International Registry and directing that the associated payment be made.

3 Upon receiving the approval of his/her administrator and following successful testing of his/her ability to access the website, a registry user will be issued a digital certificate by the administrator via an email containing a link to the website. The registry user should then download from the website the digital certificate, providing him/her access with his private key.

11.3. Effecting, Amending and Discharging Registrations – Registry User

1 To effect, amend or discharge a registration, a registering person shall:

- (a) follow the relevant process and instructions specified on the website; and
- (b) complete the electronic forms contained on the website, with the relevant information required by the TSGA.

Registration information electronically provided on the website shall be used by a registering person, as required by the TSGA. To the extent such information is not provided, registration information shall be inserted by a registering person following the instructions specified on the website.

2 An administrator may, at his/her sole discretion, authorise one or more of his/her approved registry users or professional users to effect, amend or discharge a registration. The authorisation may cover one or more items of railway rolling stock, including a group registration. Several users may be authorised to work on the same railway rolling stock, but not simultaneously during the same registration session. An administrator may, at any time, revoke an authorisation he/she has given and grant further authorisations to qualifying registry users.

- 3 Upon receipt of a confirmation pursuant to Section 12.2, any named party wishing to ensure that the respective entry has been correctly made may undertake a priority search.
- 4 Rectification of any error or inaccuracy in a registration, once searchable, may only be effected through an amended registration.
- 5 Initiated, but not completed, registrations, amendments or discharges shall not appear on any search results.
- 6 For the purposes of this Section 11, a group registration or amendment or discharge thereof shall be considered as one registration, amendment or discharge as appropriate save that the Registrar shall allocate a group file number to such group registration in addition to the file number for each item of railway rolling stock referenced in such group registration.

12. Sizing assessment

Figures should be considered as indication

12.1. Stakeholders

Item	Description	Volume
Producers	Railway Undertakings	50 to 500
	TSGA	1
Consumers	Producers	See Railway Undertakings
	GDS, data aggregators, ...	10 to 100
	Public authorities	Estimated 500
	Upcoming third parties	~10

Total amount of stakeholders: 51 to 500 producers, 570 to 1110 consumers, 621 to 1610 total

12.2. Number of resources to be handled

Data type	Resource	Number
Timetable	Full timetable data	= Number of producers
	Delta timetable	= Number of producers
Fares and prices	NRT	= Number of producers
	IRT	= Half the number of producers
	Special fares	= 0 (unused)
Reference data	Domestic fares	= Number of producers
	Passenger code lists	1
	Country codes	1
	Location codes	1
e-Fulfilment data	Company codes	1
	Public keys	= potential of distributors: RUs + travel distribution providers = 60 to 600
	Other fulfilment data	= Potential of producers supporting P@H => 50 up to 500

Booking	Reservation only for NRT IRT	= 2/3 producers
PRM assistance	PRM support services	= potential of all RUs: 50 to 500

13. Provisions for administrators and Consumers of Registry services

13.1. Service to Consumers

1 No individual other than an administrator may effect, amend, discharge or consent to registrations with the International Registry until the individual has been approved as a registry user by the administrator of the registry user entity that such person represents.

2 No registry user may transmit information to the International Registry to effect, amend or discharge a registration in respect of railway passenger services data unless such registry user has first received authorisation to do so in relation to such railway passenger services data either:

- (a) in the case of a transacting user, from the administrator of the transacting user entity that represents it; or
- (b) in the case of a professional user, from the administrator of the transacting user entity being such professional user's client.

3 Each registry user:

- (a) shall keep his/her password and digital certificate secure;

4 Each registry user shall notify his/her respective administrator of any security breach, of which he/she is aware, that is expected to result in unauthorised registrations, including unauthorised use, disclosure or compromise of his/her password or private keys.

5 Each registry user acknowledges that his/her respective administrator may make such identity checks as the Registrar considers necessary in connection with such registry user's access to the International Registry.

13.2. Service Administrators

1 An administrator, who is an employee of a registry user entity, shall be duly appointed by each registry user entity, with authority to act on its behalf for the purposes of the International Registry, and such authority shall be represented during the approval process.

2 An administrator should hold appropriate formal professional qualifications commensurate with the requirements of the functions of administrator.

3 Each registry user entity may have only one administrator at any given time.

4 The administrator of a transacting user entity, who has been approved by the Registrar, is automatically authorised to effect, amend, discharge or consent to registrations in which that entity is a named party.

5 An administrator:

- (a) shall keep his/her password and digital certificate secure;

6 Where an administrator electronically delegates his/her powers to an acting administrator, that acting administrator shall be deemed to be the administrator for the purposes of these Procedures.

7 Where an administrator electronically approves a registry user to act on behalf of a registry user entity, the Registrar shall issue an email to that registry user containing a link to a digital certificate in accordance with these Procedures.

8 An administrator shall, through the website:

- (a) keep up to date the email address and other details of the administrator and each registry user representing such registry user entity held by the International Registry;
- (b) promptly revoke the approval of a registry user representing such registry user entity in the event that such registry user leaves the employment of, or otherwise ceases to be associated with, such registry user entity; and
- (c) promptly revoke the authorisation of a registry user representing such registry user entity in the event that such registry user is no longer authorised to effect, amend, discharge or consent to one or more registrations in which that entity is a named party.

9 In the event that an administrator is to leave the employment of the registry user entity on whose behalf he/she is authorised to act or if there is to be a change of administrator, the administrator shall electronically notify the Registrar thereof in a timely fashion. Should the registry user entity wish to appoint a replacement administrator, such appointment shall be subject to a sign-up fee applicable to a new administrator.

10 The administrator of a registry user entity shall have the authority, through the website, to block and/or disable the user account of any registry user representing his/her registry user entity. It is the administrator's responsibility to take such action promptly in the event of a security breach relating to any such registry user's user account, of which he/she has actual knowledge, including but not limited to compromise of such registry user's private key.

11 The administrator of a registry user entity shall notify the Registrar of any security breach (for example, a breach compromising a private key), of which he/she has actual knowledge that is expected to result in unauthorised registrations. If the security breach relates to a registry user account, the administrator may block and/or disable the account.

12 If the account of an administrator is subject to a security breach that could reasonably be expected to result in unauthorised access to and use of the International Registry, the Registrar and the registry user entity shall cooperate to expeditiously take corrective action appropriate under the circumstances. A registry user entity shall designate a "back-up contact" for these purposes.

13 On notification of a security breach, the Registrar may block and/or disable any user account.

14 The Registrar may make such reasonable identity checks of a proposed administrator as the Registrar considers necessary in relation to that person undertaking such function. The Registrar may make similar checks of a registry user, where deemed necessary by the Registrar.

15 Each administrator may electronically approve further registry users to act on behalf of the registry user entity which that administrator represents (when authorised to do so) and may approve the issue of a digital certificate to each of those registry users.

16 The administrator has sole responsibility for the selection of his/her registry user entity's registry users and for ensuring that only individuals who are duly authorised to act on behalf of his/her registry user entity are appointed as registry users from time to time.

14. Migration from existing situation to TAP TSI environment

14.1. Registering to the TAP ecosystem through TSGA

This is new. This is a manual process. It's a one time action. The RU receives credentials to access the Common components. No migration is needed.

14.2. Subscribing to a notification for chosen resources

This is new. It's a manual process. This action is made at the beginning and then on a case to case basis. By accessing the Registry, the RU will be able to select the Resources it wants to be notified for every change. No migration is needed.

14.3. Getting the Reference data from RRD

This is new. This is an automatic process. It's done the first time an RU is becoming a member, using its access to the RRD. Then it can be done anytime or each time the RU receives a notification that something in RRD has changed (new reference data or change or delete). No migration is needed.

14.4. Checking quality of Resources (Timetables and Tariffs/Fares)

The quality is already checked by existing tools (Merits, Prifis). Should the same tool being used, RUs will have no migration tasks. Otherwise, RUs will keep using the existing tools and won't use a potential new tool (using DQM is not mandatory). No migration is needed.

DQM also checks the RRD references (location codes) in the uploaded Resources against the RRD. In order to be sure that the Timetables and Fares contain the clean dataset, the usage of DQM is mandatory.

14.5. Making available Resources

There are no changes for RUs already making available their resources for the other RUs. No migration is needed.

14.6. Informing the Registry of a new Resources available

This is new. RUs will have to use the specification of the Registry supplier to do it. It can be manual or automatic. The RU will access the Registry and deliver an information on the new resources being available. This will trigger the notifier which will in turn send a notification to all members that have subscribed to be notified for that specific Resource. No migration is needed.

ANNEX 1 – GLOSSARY

<i>Term</i>	<i>Explanation</i>
Access Method	Specification of technical means (or interface) by which a system accesses another. The Registry stores the access methods for each RU and will give to Resource Consumers the needed information for data exchange Message format Transport protocol Server address and port
Accessibility data	Accessibility data consists of the information related to the accessibility of passenger railway stations that needs to be collected, maintained and exchanged, that is to say, of a description of the characteristics and equipment of the passenger railway stations.
Checksum	a <i>checksum</i> is a simple type of redundancy check that is used to detect errors in data
Company Codes	Reference data listing unique identifiers for Companies participating in the TAP TSI Retail Architecture and subject to the TAP TSI Regulation

Control Certificate	Transactional Resource made available by a Ticket Controlling Organisation (a type of Resource Producer) to support the print@home TAP TSI Regulation process This is valid for the e-Fulfilment methods as described in the B7 technical document.
CRUD	CRUD stands for Create, Read, Update and Delete (Retrieve may occasionally be substituted for Read.)
Data Quality Management (DQM)	A common component of the TAP TSI Retail Architecture providing Data Quality Management services to both Resource Producers and Resource Consumers. The component performs quality management checks and produces reports to the requester.
European Union Agency for Railways (ERA)	EU Agency for Railways is established to provide the EU Member States and the Commission with technical assistance in the development and implementation of the Single European Railway Area.
TSGA	The body dedicated to TAP TSI, responsible for implementing and operating the TAP TSI regulation through the TAP TSI Governance Process
IRT	Integrated reservation ticket
Partial Schedule	A partial schedule is integrated with other Partial Schedules of the same service to build the end to end schedule. A Resource Producer is only responsible for the delivery of the Partial Schedules it is in control of.
Notification	A message generated by the Registry to Resource consumers that have subscribed to receive Notifications regarding a specific Resource, upon detection of that Resource being made available or updated by Resource Producers
NRT	Non-integrated reservation ticket
Passenger Code List	List of allowed values for specific data types managed by the TSGA, centrally stored and available in a computer readable format to both Consumers and Producers. ERA will make the Passenger code list and location reference data publicly accessible. This list will be registered as a Resource by the TSGA acting as a Resource Producer
PRM	Person with reduced mobility
Public Key	Resource made available by an Actor to decrypt a file encrypted by the same actor with its Private key. An application in TAP TSI is for a Distributor (a type of Resource Producer) to support the print@home TAP TSI Regulation process. This is valid for the Digital Signed Ticket (DST), one of the possibilities of e-Fulfilment methods as described in the B.7 technical document).
Reference location Data	Reference data listing unique identifiers for Locations used in the TAP TSI Retail Architecture managed by TSGA. It will be stored centrally and will be accessible by both Resource Producers and Resource Consumers in a machine readable format. It will be registered by TSGA acting as a Resource Producer
Registrar	A role in the Governance process charged with administration of the Registry

Registry	The Registry is a Central Repository listing Resource names, addresses and Access Methods, made available by Resource Producers for the Resource Consumers. It also registers subscriptions to Resources by Resource Consumers.
Registry Service Provider	Organisation selected through a tender process to manage the hardware and software environment implementing the Registry.
Resource	Files, interfaces, endpoints or data elements made available by Resource Producers and accessed by Resource Consumers through Access Methods
Resource Delivery	Delivery of a resource” indicates the operation of making a resource available. The term “delivery” therefore does not imply “sending” data but consists in registration in the Registry
Resource Subscription	A Resource Consumer is associated with one or more Resource Subscriptions entries, each consisting of the “Resource Name” and, optionally a list of selected Resource Producers of that Resource.
Retail Reference Data (RRD)	A common component of the TAP TSI Retail Architecture providing Access Methods to Reference Location Data, Passenger Code lists, specific retail codes (Retail Data) and Company Codes
TAP TSI Governance Process	The process of administering the TAP TSI Regulation
TAP TSI Regulation	The Commission Regulation (EU) No 454/2011 of 5 May 2011 on the technical specification for interoperability relating to the subsystem ‘telematics applications for passenger services’ of the trans-European rail system, including its Technical Documents

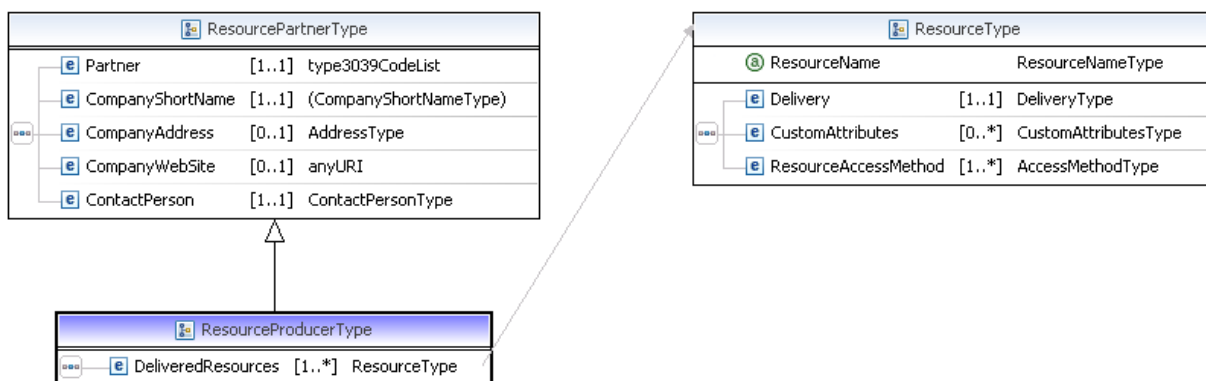
ANNEX 2

This Annex provides a description of the Registry’s main persisted objects representing a high level model of Registry entries declaring Resource Deliveries, i.e. resource made available by Resource Producers, and Resource Subscriptions, i.e. subscriptions to Resource Delivery updates requested by Resource Consumers.

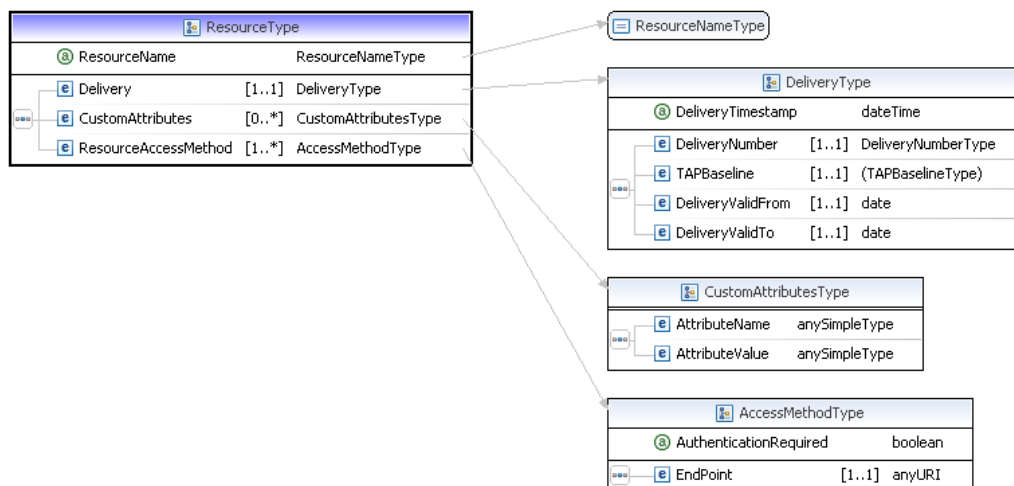
The model is intended solely for the purpose of illustration of the Landscape detailed in chapter 7 and does not constitute a specification for implementation. It can be used however as a guideline for such detailed specification.

Resource Deliveries

Resource Deliveries may be declared in the Registry with entries of the following format:



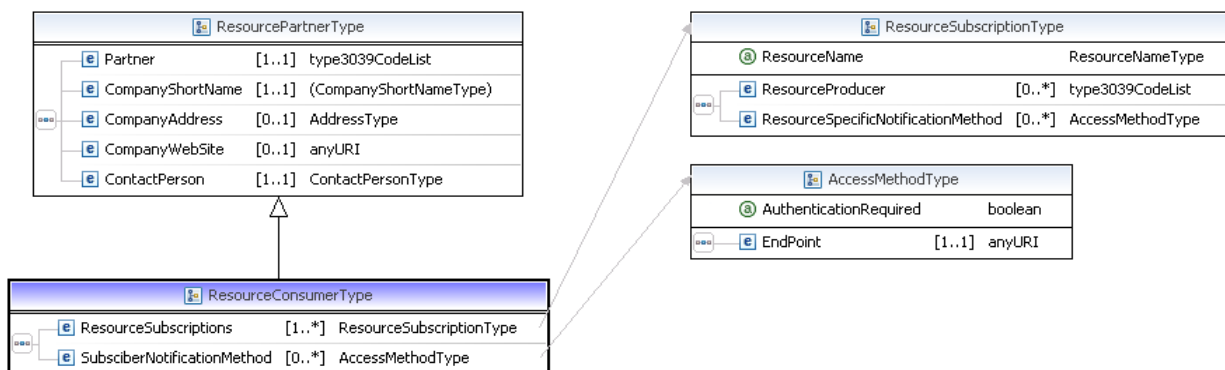
A delivering Resource Producer is therefore associated in the Registry with a minimum of one and an unbounded maximum of Resources, each described by a Resource Name indicating its time (e.g. “TIMETABLE”, “FARES”, etc) and a Delivery object, as follows:



A Resource Delivery is further described by specifying the baseline number of the TAP TSI document under which the Resource is created and start and end validity dates, and custom attributes.

Resource Subscriptions

Resource Consumers can subscribe to notifications about specific Resources. The notifications are sent by the Registry automatically when a Resource Delivery is added, updated or removed by a Resource Producer to all Resource Consumers that subscribe to that specific Resource, indicated by its ResourceName.



As illustrated in the diagram above, a Resource Consumer is associated with a minimum of one and an unbounded maximum of ResourceSubscriptions, each consisting of the mandatory ResourceName and, optionally, specifying that ResourceNames from a specific Resource Provider are being subscribed.

A *unique combination* of the Resource Consumer’s “Partner” attribute, and of the Resource Name attribute exists in the Registry, such as:

Partner	ResourceName	ResourceProvider
83	TIMETABLE	ALL
83	FARES	87
87	TIMETABLE	83

The first entry specifies that Resource Consumer ‘83’ subscribes to notifications about Resource TIMETABLE from any Resource Provider, the second that it subscribes to notifications about Resource FARES delivered by Resource Provider ‘87’, and the third that Resource Consumer subscribes to notifications about Resource FARES delivered by Resource Provider ‘83’.

The relationship of a Resource Consumer to Resources it subscribes to is a *composition*: deletion of the Resource Consumer from the Registry removes all ResourceSubscriptions associated with it. Conversely, there can be no ResourceSubscriptions *not* associated with its owning Resource Consumer.

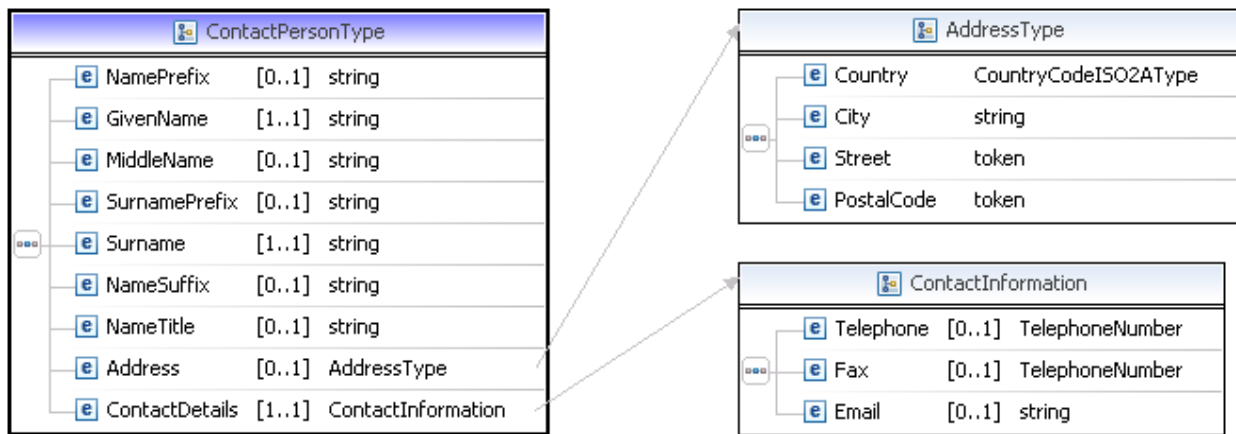
Resource Producers and Consumers

ResourceConsumers and ResourcePartners have attributes in common: this is modelled as Producers and Consumers being specialisations of a “ResourcePartner” entity, whereby a Resource Producer is a Resource

Partner associated with one or more DeliveredResources, and a Resource Consumer is a Resource Partner associated with one or more Resource Subscriptions.

A ResourcePartner such as a Data Quality Tool does not have a street address but it *must* have a ContactPerson

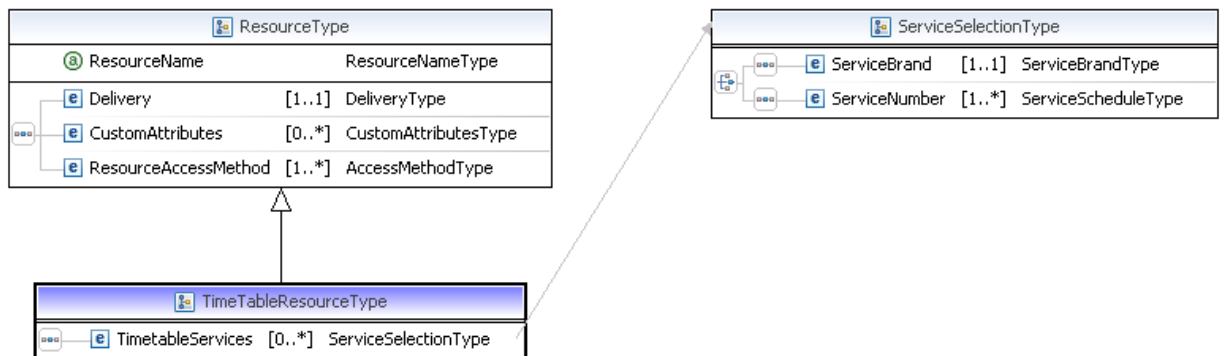
A ContactPerson entity is described below:



ResourcePartner (therefore both Producers and Consumers) have at least one ContactPerson, who must have at least one ContactDetail consisting of either phone, fax or email.

Timetable Resources

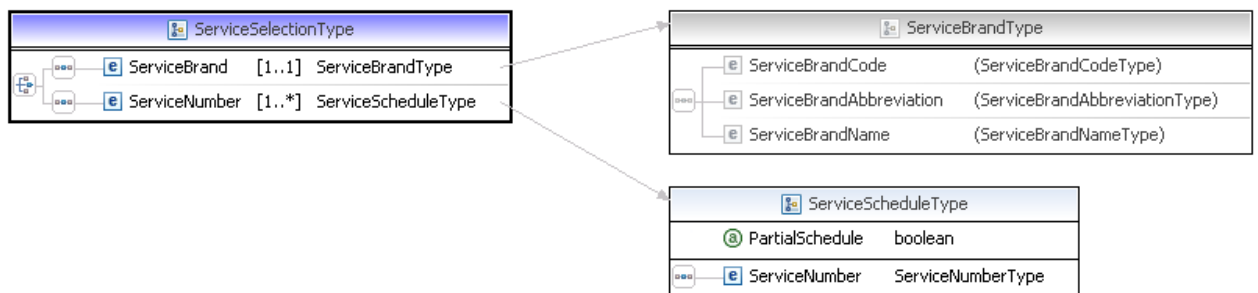
Timetable resources are represented in the Registry as extensions of the Resource entity, as follows:



A Timetable Resource is associated with an unbounded number of TimetableServices describing either a list of Service Brands and/or a list of Service Numbers included in the Timetable delivery.

A Resource Producer making a Resource Delivery of Timetable which specifies Service Brand and/or Service Numbers is the Information Provider for those Service Brands and/or Service Numbers.

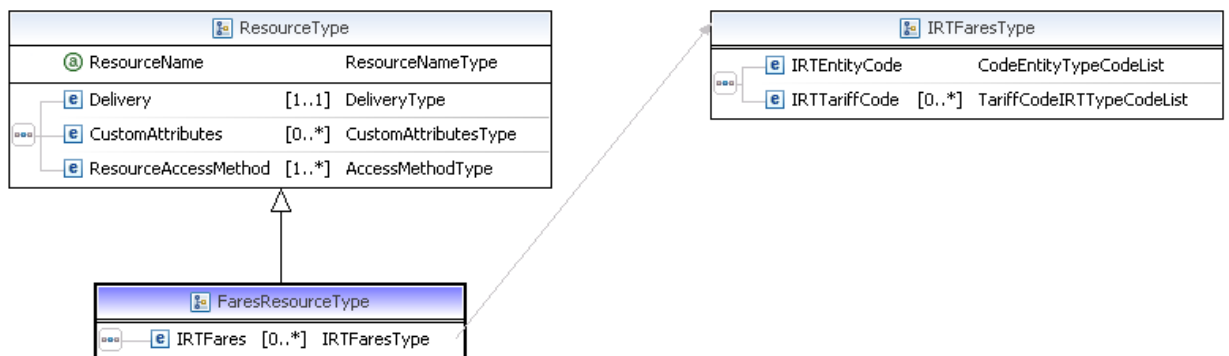
A Service Number declared in the list of TimetableServices is furthermore associated with a PartialSchedule attribute:



A PartialSchedule attribute set to ‘true’ for a Service Number indicated that the Timetable contains a partial schedule for that Service Number that needs to be integrated according to the specifications of the relevant Implementation Guide.

IRT Tariffs/Fares Resources

IRT Fares resources are represented in the Registry as extensions of the Resource entity, as follows:



A Fares Resource is associated with an unbounded number of IRTFares describing a list of EntityCodes and/or IRT TariffCodes from the relevant TAP TSI Codelists

NRT Tariffs/Fares Resources

Same principles as above

Special Tariffs/Fares Resources

Same principles as above

Reservation Resources

Same principles as above

Public Key Resources

Same principles as above

Code List Resources

Same principles as above

Data Quality Tool Resources

Same principles as above

Access Methods

Access method for all services is secured. As indicated in NFR5, all services will be available via https (via SSL - Secure Socket Layer).

The Resource Consumer is required to authenticate when accessing any of the services.

The authentication is provided through Single-Sign-On (SSO) approach via TSGA central service application. No other authentication is accepted.

File Transfer Access Method

Exchange of the files is done through the TSGA central service application. The access for upload and download of files (e.g. Timetables or Fares) is done only via https (SSH) to and from the URL provided automatically by the TSGA central service application.

The Resource Providers upload the files to the dedicated folders of the TSGA central service application which are automatically created by the application. The folder structure is intuitive, according to the country and company that the Resource Producer belongs to. The file names are also constructed automatically by the TSGA central service application as specified for resource subscription.

Web Service Access Method

For accessing of the API (Application Programming Interface) for web service calls:

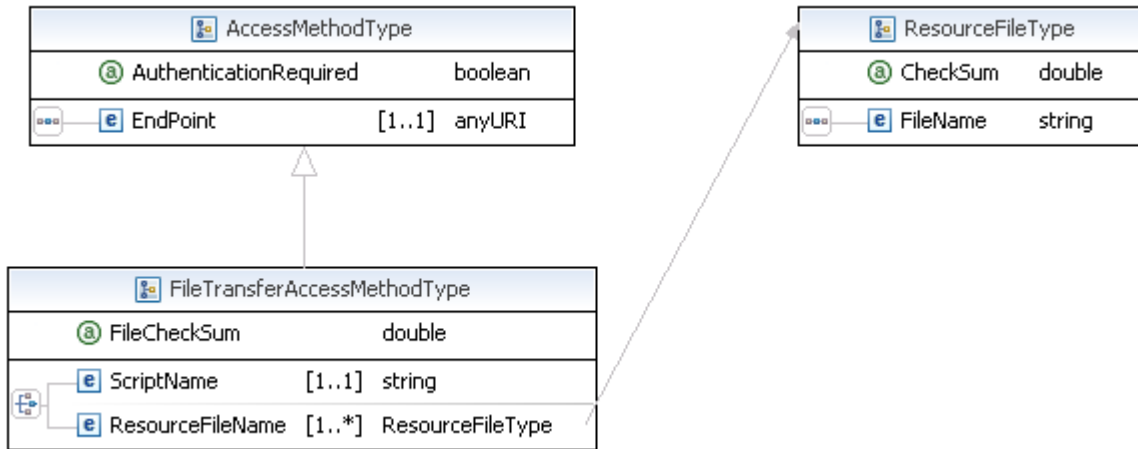
- Representational State Transfer (REST) web services are used
- JSON (JavaScript Object Notation) is used for transfer of objects
- the authentication is required
- the concept of JSON Web Token (JWT) is used for security and authentication purposes
- all REST calls are done via https (SSL)
- the documentation of the REST web services and JSON objects is provided by the TSGA central service application directly, and is available only for the TSGA central service application authenticated users

An Access Method specifies an endpoint and an AuthenticationRequired attribute to indicate that authentication by the Resource Consumer is requested at the endpoint:

AccessMethodType	
AuthenticationRequired	boolean
EndPoint	[1..1] anyURI

File Transfer Access Method

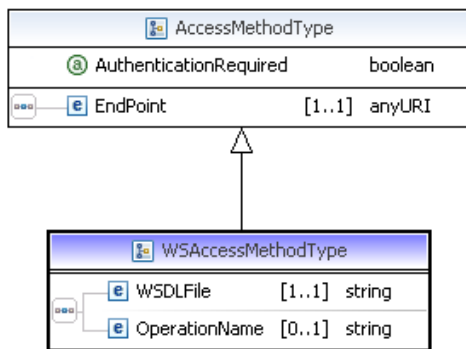
A File Transfer access method extends the Access Method with specific attributes pertaining to file transfer:



It can specify either a script to be run at the endpoint (such as a server side script on a web or ftp server), or an unbounded list of ResourceFiles, each consisting of a Filename with a CheckSum.

Web Service Access Method

A File Transfer access method extends the Access Method with specific attributes pertaining to a web services interface:



It specified the name of a web services definition language (WSDL) file and an operation name to invoke in the call.