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D1.2.1

Data Model

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GET SERVICE

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Executive summary

This report describes the data model that is used in the GET Service project. By doing so, it provides definitions for the concepts that are used in the GET Service project, as well as their relations.

1 Introduction

This deliverable presents the data model of the GET Service project. This section provides the background to this deliverable, by presenting the goal of the project as a whole, the goal of the work package of which the deliverable is a part, and the goal of the deliverable itself. Finally, it presents the structure of the remainder of the deliverable.

1.1 Project Goal

The GET Service platform provides transportation planners with the means to plan transportation routes more efficiently and to respond quickly to unexpected events during transportation. To this end, it connects to existing transportation management systems and improves on their performance by enabling sharing of selected information between transportation partners, logistics service providers and authorities. In particular, the GET Service platform consists of components that: (i) enable aggregation of information from the raw data that is shared between partners and transportation information providers; (ii) facilitate planning and re-planning of transportation based on that real-time information; and (iii) facilitate real-time monitoring and control of transportation, as it is being carried out by own resources and partner resources. By providing this functionality, the GET Service platform aims to reduce the number of empty miles that is driven, improve the modal split, and reduce transportation times and slack, as well as response times to unexpected events during transportation. Thus it reduces CO_2 emissions and improves efficiency.

1.2 Work package goal

This deliverable is part of work package 2, which has as its goal to develop a detailed architecture that governs the integration of the different components of the GET Service platform, ensure integration of the GET service platform with other components of the European Wide Service Platform, develop the core components of the GET Service platform, and integrate the components of the GET Service platform into an operational platform.

1.3 Deliverable goal

This deliverable presents the data model for the GET Service project. The data model provides definitions for the concepts that are used in the context of the project. As such, its primary goal is to facilitate an understanding of the data entities that are being exchanged both within the project and, once the GET Service platform becomes operational, between the platform and external data and service providers.

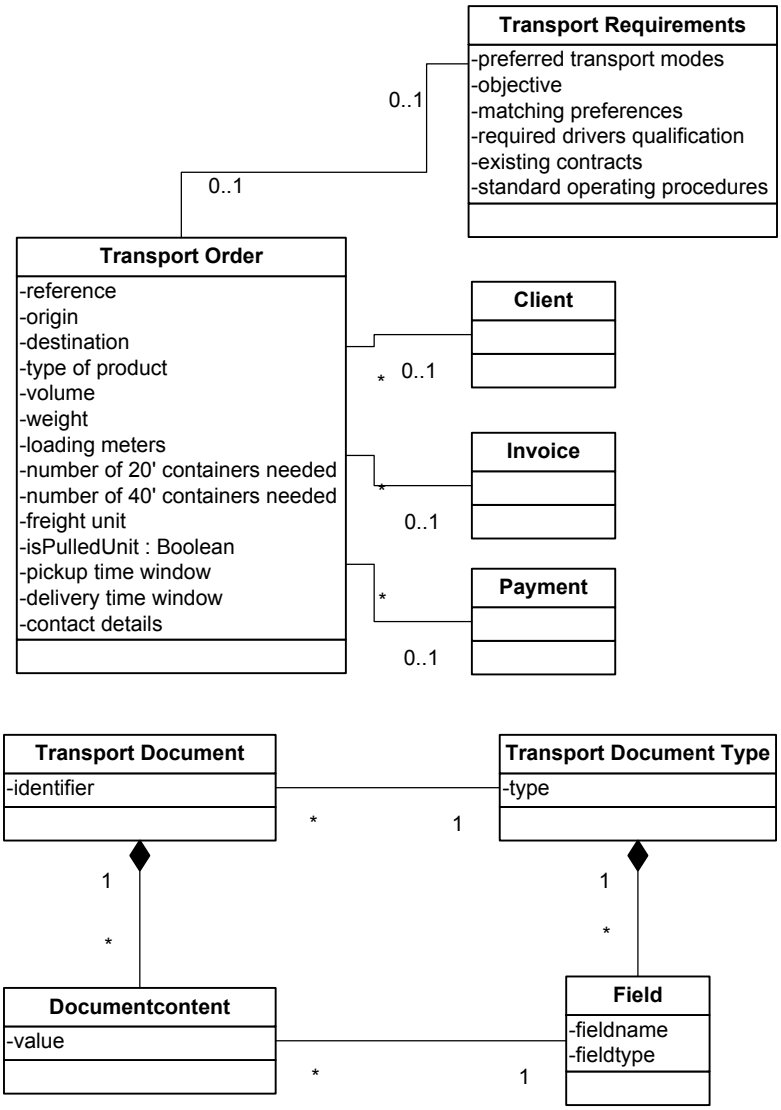
1.4 Deliverable structure

The data model is separated into four packages:

1. administrative information, which contains administrative information about the transport order and transportation schedules;
2. planning information, which contains information relevant to create a transportation plan;
3. process information, which contains information about a certain transportation plan and the end-to-end business process that is used to execute that transportation plan; and
4. real-time information, which contains information on all expected and unexpected events of which the system is notified and that may affect the transportation plan.

These packages are explained successively in the subsequent sections of this deliverable.

2 Administrative Data



The administrative information is split up into two parts. These parts are related via concepts from other packages.

The first part is information containing the transportation order. It contains detailed information concerning the order itself (type of goods to ship, when to ship them, where to ship them, …) along with information about the client, the invoice that may have been sent and the payment that may have been received. Information about the client, invoice and payment have not been described in detail, nor is any other information that may be kept about transportation orders. We consider this information out-of-scope for the GET Service system.

The second part of administrative information is information on transportation documents. Documents are stored in a generic manner. Document ‘types’ can be defined, along with the fields that these documents contain and the type of information that should be stored in that field. Then, several instances of these document types can exist. These are the actual documents. The documents have the fields that are defined by their type and should contain a value for each field. An example is a CMR form. The CMR form ‘type’ should describe the structure of the CMR form: that it has a field ‘client name’ of type ‘free text’, that it has a field ‘goods description’ of type ‘free text’, that it has a field ‘goods loaded’ of type ‘checkbox’ and so on. A CMR form should then

contain concrete values for these fields. For example, there could be a CMR form with ‘GET Service’ as value for ‘client name’, ‘TomTom devices’ as value for ‘goods description’ and ‘no’ as value for ‘goods loaded’.

2.1 Detailed concept description

Transport Order
An order, received by the planner, requesting to fulfill the transport needs of a client.

Example:
Reference=12345
Origin=”XXX”
Destination=”YYY”
Type of product=”ABC”
Volume=20
Weight=20
Loading meters=20
Number of loading units=1
Loading unit=”Z”
Pickup time window=d/m/y : d/m/y
Delivery time window=d/m/y : d/m/y
Loading time window= d/m/y : d/m/y
Transport requirements=””
Contact details=”XYZ”

Transport Requirements
The transport arrangements or comments that require special assistance.

Example: The preferred mode of transportation, the need of a specialized driver’s license, and etc.

Client
Abstract class. Information about the person or organization on behalf of which the transportat order is carried out.

Invoice
Abstract class. Information on the invoice that was sent for the transport order.

Payment
Abstract class. Information on payment of the invoice that was sent for the transport order.

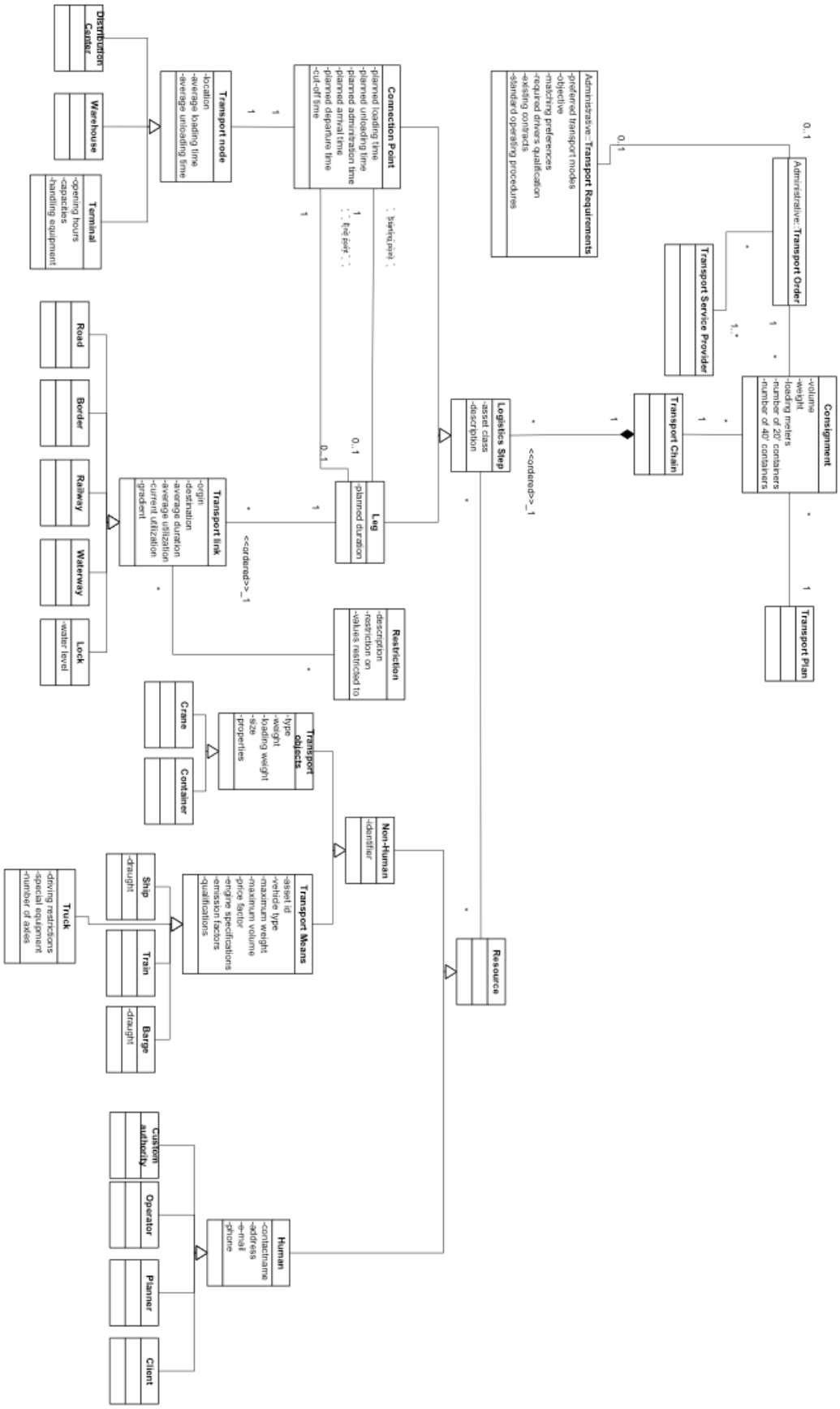
Transport Document Type
A template identying a type of document that can be used during transport.

Field
An information field that is used in a type of document.

Transport Document
A document, with an identifier or reference number, that is used during a transport. Each transport document is of a specified type.

Documentcontent
The information, filled out in a particular information field, on a document that is used during transport.

3 Planning Data



The planning information contains all details about the transportation plan and the information that is necessary to create the transportation plan.

As explained above, a transportation plan consists of steps and the planning information package provides more detail on the information that is kept about each logistics step. The planning information package also allows more detailed requirements to be provided about a transportation order, such as the primary planning objective (travel time, CO2 emission, …).

Each logistics step is associated with the resources that are used in that step. There is a large number of possible resources that can be used. In particular, we distinguish between means of transportation, containers, transportation nodes (which are places in a transportation network) and transportation links that link the places in a network. For each of the different resources we keep a variety of information. In particular, for transportation links, we keep information about the restrictions that may apply to that link, such as weight restrictions or restrictions on whether or not dangerous goods can be carried along that link.

3.1 Detailed concept description

Transport Service Provider (TSP)
Organization providing transport services.

Transport Plan
The definition of sequential activities in a logistics chain in order to achieve a certain goal, defined before transportation starts (offline) or during the transport processes (online). The latter is referred to as online re-planning. (D1.1)

Example: A transport plan for the consignment X to be shipped from A to B will be through links 1-2 and 2-3. The mean of the transportation will be road. The non-human resource (asset) is truck, namely YZ and the human-resource is MM.

Consignment
The connection of the shipments of goods with containers which are part of the same transport order via a specific transport route and with a specific transport plan.

Example: An order of 40 printers is divided into two containers, 26 printers (container 1) and 14 printers (container 2). In order to carry the consignment, a logistic service provider (LSP) from Berlin books two 20′ containers that is intended for a consignee at Amsterdam with a flat rate of Z euros. The consignment needs 10’ space and weighing 10 tons.

Transport Chain
Subset of the logistics infrastructure used for traveling from origin to destination according to a plan. (D1.1). This is the path on which consignment is transported.

Example: The transport route goes from Amsterdam to Berlin. It starts in Amsterdam on mode rail and changes in Hannover onto mode road. The transport route, thereby, connects many nodes via links in order to reach Berlin. Each link and node have attributes (like: transport time, loading time, utilization, …) which describe the use of them.

Logistics Step
The transport arrangement for a consignment from A to B. In order to move a container from A to B, the information of the transport network and available options on the network should be known in advance.

Example: From Amsterdam to Berlin, there are two possibilities. The first option is to use the road network. The second option is to use rail network. The all arangements for these two options are known by the planner.

Connection Point
A point within the network which is either a crossing within a mode or which makes a mode-change and/or bundling of consignments and/or intermediate storing of goods possible.

Example: Transport node 1 has a connection to links 2-1, 1-3 and 4-1. It is located at X. It allows changing modes between road and rail. The average unloading time per container is 5 minutes during weekend and 10 minutes weekends.

Transport Node
A point within the network which is either a crossing within a mode or which makes a mode-change and/or bundling of consignments and/or intermediate storing of goods possible.

Example: Transport node 1 has a connection to links 2-1, 1-3 and 4-1. It is located at X. It allows changing modes between road and rail. The actual unloading time per container is 5 minutes during weekend and 10 minutes weekends.

Distribution Center
Facility from which wholesale and retail orders are filled. It describes a high-velocity operation as opposed to a static storage warehouse. DC offers value-added services.

Example: Distribution Center A is located at Z. It has a 10 minutes driving distance to node B. It has a special cooling area for fresh goods.

Warehouse
A specialized building, often with refrigeration or air conditioning, which is stocked with goods to be redistributed to retailers, to wholesalers, or directly to customers.

Example: A warehouse Z is located in Berlin. It has a 20-minute driving distance to the water way X.

Terminal
Any facility where freight originates, terminates or is handled in a logistics chain. Terminals might be points of transshipment involving either the same mode of transport or between different modes of transport. (D1.1)

Example: A terminal X is the pickup point of the consignment 123, which can be shipped on road or rail through terminal X.

Transport link
The connection between two transport nodes [source and destination]. Thus, it is the tiniest section needed within a transport network. Each link thereby is connected with a specific transport mode and has some characteristics [average trip time, average utilization, current utilization]

Example: A link 1-2 connects the terminal Z and A. It is of mode road and an average trip time is 5min, 45sec. An average capacity is 40%.

Border
Border crossing point or border checkpoint is a place, generally between two countries, where travellers or goods are inspected.

Example: Terminal X is located at the border of Germany and the Netherlands. The container trains can be checked on this border with an average time of 2 hours.

Lock
An enclosed chamber in a waterway, with gates at each end, for raising or lowering vessels from one water level to another by admitting or releasing water.

Example: A current level of the lock of X is 2 meters and it takes 1 hour to be raised to 4 meters high.

Restriction
A restrictive condition or regulation.

Example: No trucks with a height over 4.25m are allowed to use the link 1-2.

Leg
Leg is defined as the total planned route from the pickup point to the delivery point on one mode.

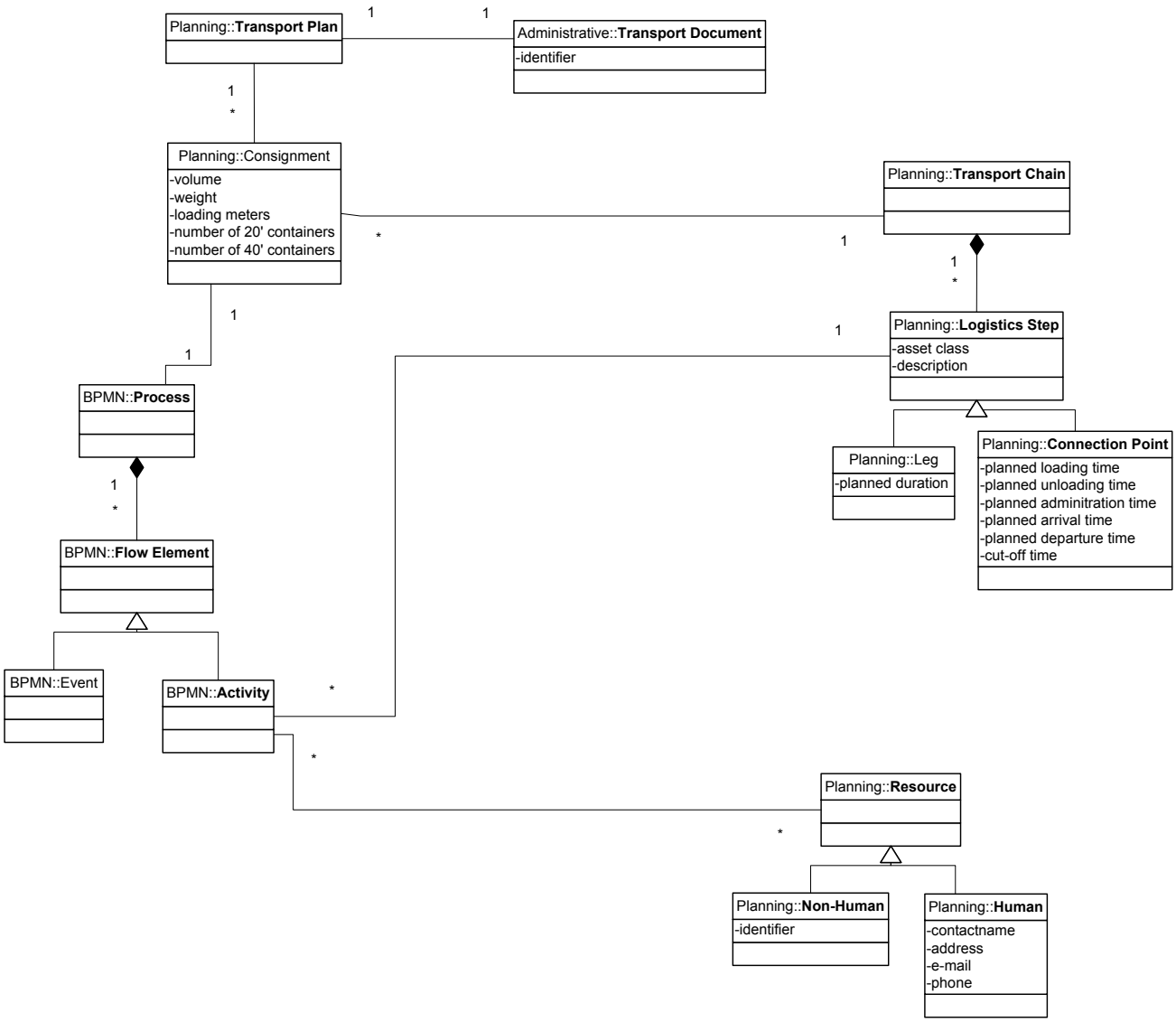
Example: From Amsterdam to Berlin, there are two legs. The first leg is on the railway from Amsterdam to Hannover while the second one is on the road from Hannover to Berlin.

Resource
A source or supply from which benefit is produced, typically of limited availability.

Example: Driver, trailer, container, etc.

Common concepts
- Road
- Railway
- Waterway
- Human
- Custom authority
- Operator
- Planner
- Non-Human
- Transport object
- Crane
- Container
- Transport Means
- Ship
- Truck
- Train
- Barge

4 Process Data



Process information consists of information about transportation plans and the end-to-end processes that are used to execute the transportation plan. Processes consist of flow elements, which can be activities (such as make reservations on the vessel), or events that represent things that happen and may influence the execution of a process as they happen. The exact behaviour that is represented by a process can be described in detail, using the BPMN notation. This notation is described precisely in Deliverable 4.1.

4.1 Detailed concept description

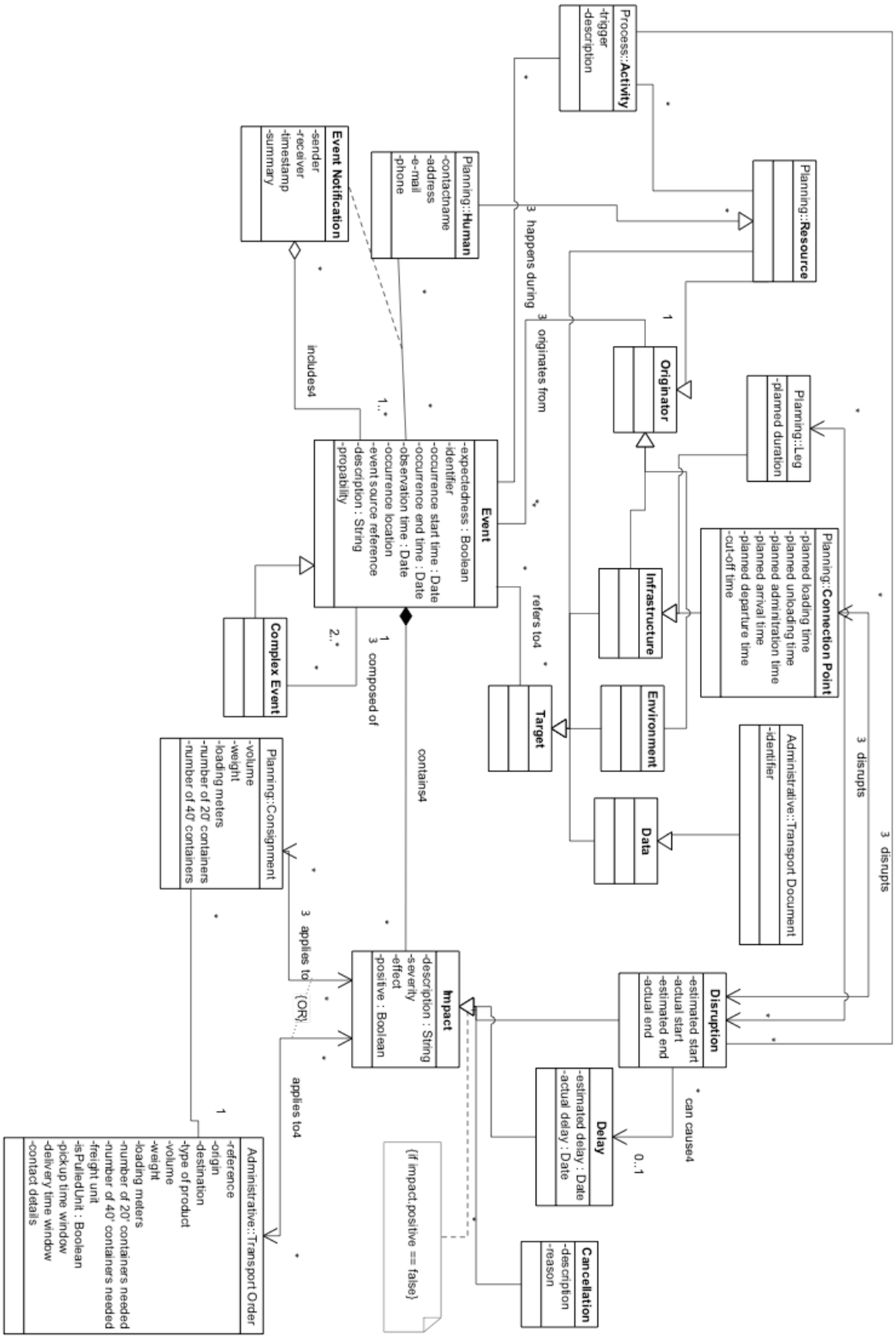
Process
The ordered depiction of the activities involved in the delivery of goods for a transport plan.

Flow Element
Abstract element of a process, which can either be an activity or an event.

Activity
Unit of work conducted in a business process (Weske 2012, p 89).

Event
Something that happens.

5 Real-time data



Real time information consists of event notifications. We store the activity to which events are relevant, thus allowing structured monitoring of the transportation plan, by monitoring precisely those events that are relevant to the activities in a particular transportation plan.

We distinguish between different types of events, depending on their impact. In particular, we distinguish between disruptions, delays, and cancellations.

5.1 Detailed concept description

Event
An event is an occurrence within a particular system or domain; it is something that has happened, or is contemplated as having happened in that domain (Etzion and Niblett, 2010). It contains the values of predefined attributes as well as additional data parameters (Luckham, 2002, p. 151):

- The expectedness defines for the target whether the event is expected or not.
- The identifier is the unique label of an event. It is likely to be used for the storage and the unique identification of an event as event object in an information system.
- The occurrence start time is defined as starting date on which the event occurred.
- The occurrence end time is the date representing the end of the event. By using the occurrence start and end time the validity of the event can be derived.
- The date and time on which the event was observed is stored as observation time.
- The creation time defines the date the event was created in the information system.
- The place where the event occurred is defined in the occurrence location of an event. The occurrence location is given via coordinates that might describe a single point, an area, or a polygon.
- The event source reference stores the source of an event, i.e. the entity which publishes an event.
- The textual summary is stored as description in an event.

Example: Road Construction

Originator
An originator is an entity from which the event was raised.

Impact
The impact defines the consequences of the event for a target. An impact can be positive (e.g., a truck being loaded on time according to the schedule does not cause any negative effect on the ETA), or negative (e.g., the loss of one of the documents required in customs or in inspections may affect not only the ETA but also other aspects of the initial plan, which may imply for instance the cancellation and re-booking of assets and resources in case re-planning is required), giving rise to what we call expected and unexpected events, respectively. The negative impact can further be subdivided into delay, disruption, or cancellation.

Disruption
A vehicle involved in an accident may be broken and cannot be used for consignment anymore which leads to a disruption of the current transportation

Delay
A blocked road may lead to a delayed ATA (actual time of arrival) of a truck at its destination

Cancellation
A client cancelling his/her delivery order would lead to the cancellation of the corresponding consignment

Event Notification

An event notification is a datum that reifies an event, i.e., it contains data describing the event. It may just indicate the plain occurrence, but often may carry additional information describing the circumstances of the event (Muehl et al. 2010).

Complex Event
Using a specific set of constructors on events such as disjunction, conjunction, sequence, etc., we can create complex events.

Target
An entity of the transportation that can be involved in the event; i.e. an entity the event refers to. Depending on the target of the event the actions that can be done over them differ.

Example: In case a road is blocked the action for the road could be to conduct repairs while the action for a driver taking that road might be to take a different route.

Environment
For the case events are related to the status of the environment, such as the weather conditions or the degree of pollution generated by the transportation means.

Example: We should be aware of events related to a wrong functioning of vehicles or devices that might derive in surpassing the thresholds of pollution considered acceptable.

Data
For the case event are related to information handled in the process, such as orders, bills and other documents exchanged between the parties involved (e.g. the MRN number provided in customs).

Infrastructure
The infrastructure used in each type of transportation can also be target of events such as construction sites that have started or finished, or roads or railways that have been blocked for any reason.

6 Conclusions

This deliverable described the data model of the GET Service project. The data model consists of four separate packages.

For each of these packages, the data model is provided. The data model is briefly explained and each data object is defined precisely. Each package is related to other packages by referencing data objects from other packages.

References

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