



DOCUMENTATION ROUTING REPARTO SERVICE



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2. Introduction

This document describes the calls and parameters that the Routing Split server tolerates.

The Routing Reparto server is accessed via the URL

<http://www.routingreparto.com/planificador/server?>

Communication with the server is done by HTTP using GET requests (if the parameters do not exceed 1024 bytes) or POST with enctype **multipart/form-data** or **application/x-www-form-urlencoded**.

The server always returns an XML response unless otherwise specified.

All requests to the server must include the Cercalia distributor code and optionally the client code. Prevent third parties from gaining access to your reseller code.

3. Planning

3.1 Request for planning

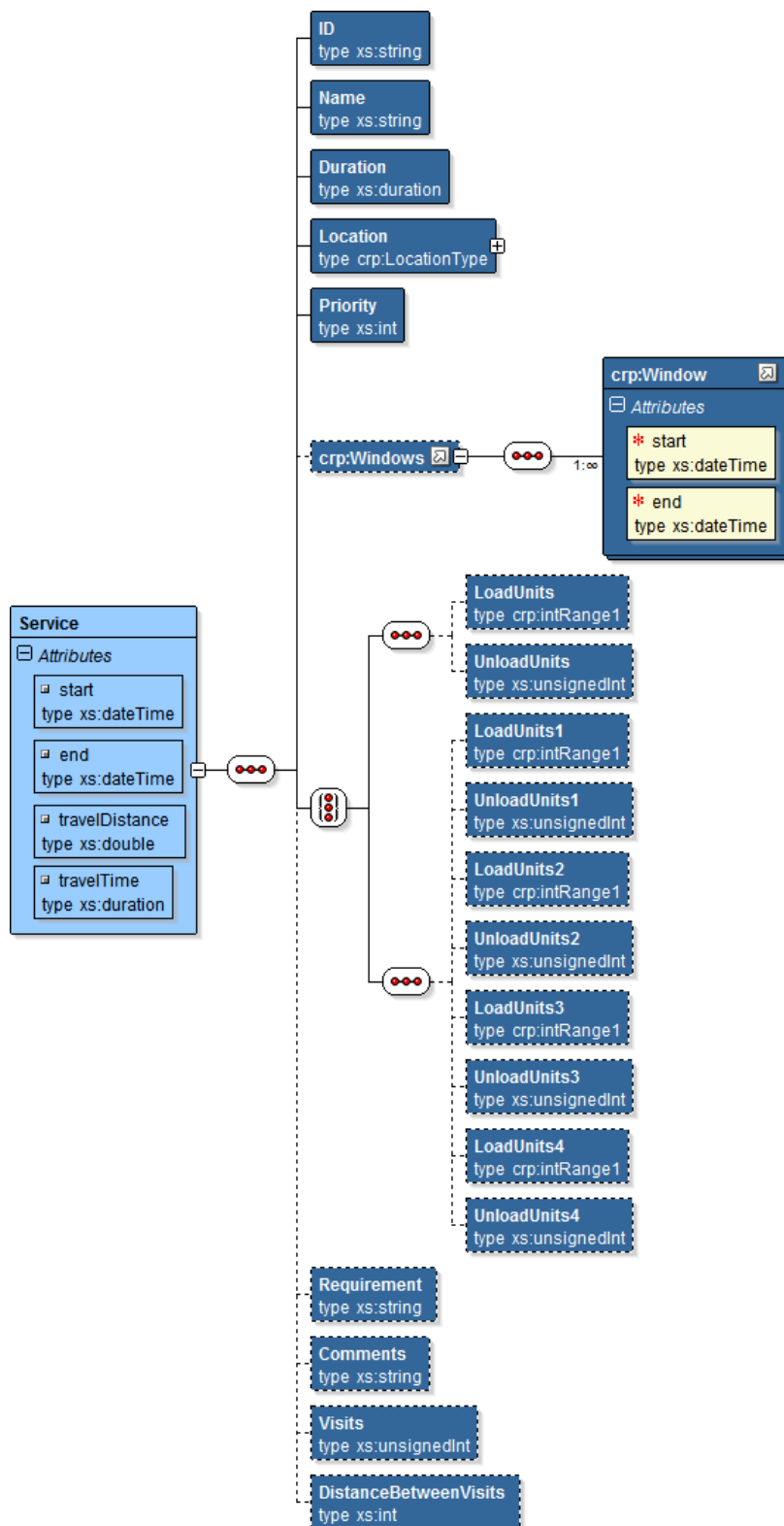
The planning request will consist of the following parameters:

Commander	It should always be start .
clientid	Distributor code or distribuidor_cliente. (Required)
client	Client code. (Optional)
request	XML with the structure: <pre><Request> <Vehicles> ... </Vehicles> <Services> ... </Services> <Settings> ... </Settings> </Request></pre> Optionally, one or more of the above sections may not be specified and the following parameters may be reported:
Services	Xml with the specification of the services to perform. <pre><Services> ... </Services></pre>
Vehicles	Xml with the vehicle specification. <pre><Vehicles> ... </Vehicles></pre>
Settings	Xml with the planning parameters. <pre><Settings> ... </Settings></pre>

The Services and vehicles must be correctly georeferenced (with the coordinates provided). If they are not georeferenced, use the "bulk geocodifier" or the "validator" to

georeference them.

3.1.1 Specification of Services (Clients)



Description of the data of a Service:

ID	Unique identifier of the service.
Name	Name or description of the service.
Duration	Duration of the service.
Location	Place where the service is performed.
Priority	Priority over other services.
Windows	Service windows (Intervals of time when service can be performed)
Requirement	Requirement on the vehicle's capabilities.
Comments	Special comments about the service.
LoadUnits<X>	Units of type <X> loaded. Where <X> can be a numeric from 1 to 4. If only one unit type exists, you can use the LoadUnits parameter.
UnloadUnits<X>	Units of type <X> discharged. Where <X> can be a numeric from 1 to 4. If only one unit type exists, the UnloadUnits parameter can be used

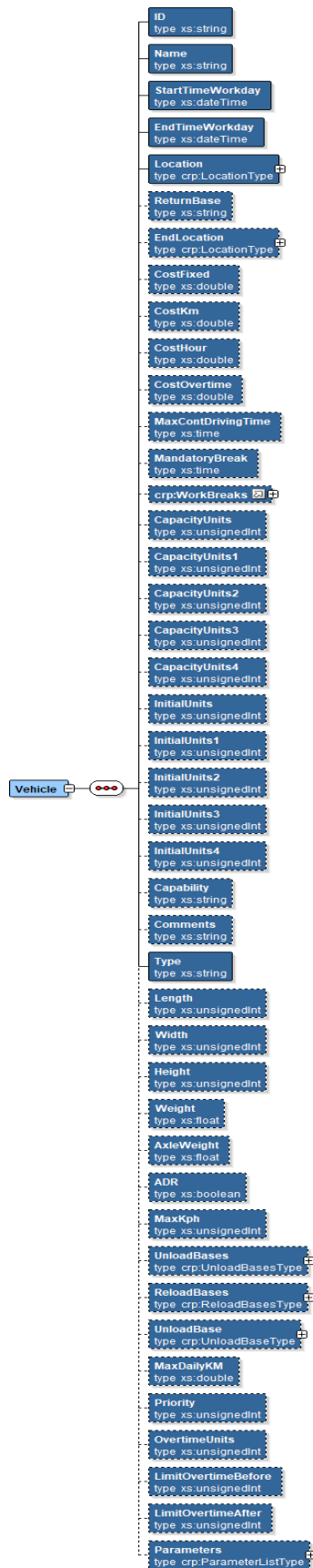
For example:

```

<Service>
  <ID>1</ID>
  <Name>Hotel1</Name>
  <Duration>PT0H35M0S</Duration>
  <Location>
    <Address>Paseo de la Castellana</Address>
    <HouseNumber>261</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28046</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.6856079476855728" y="40.48107680454417"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </Location>
  <Priority>1</Priority>
  <Windows>
    <Window start="2019-10-03T09:00:00" end="2019-10-03T14:00:00"/>
    <Window start="2019-10-03T16:00:00" end="2019-10-03T18:00:00"/>
  </Windows>
</Service>

```

3.1.2 Vehicle Specification (Resources)

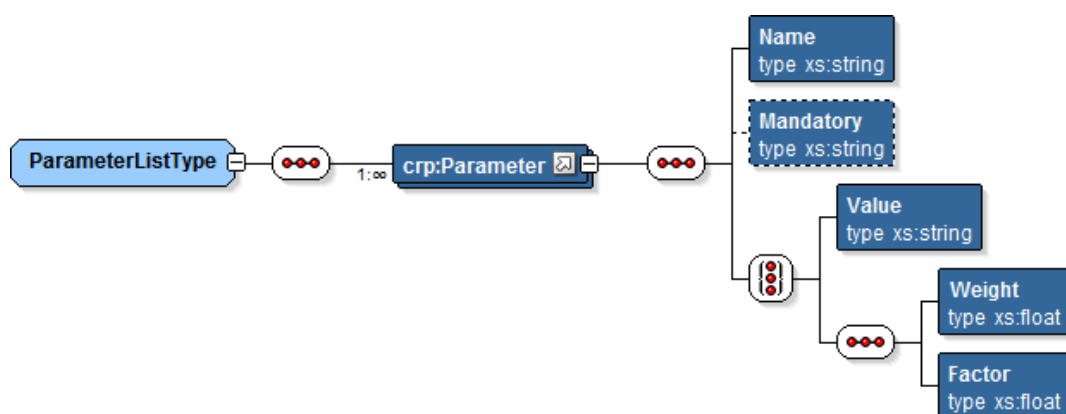


Description of the data of a Vehicle:

ID	Unique Vehicle Identifier
----	---------------------------

Name	Vehicle Name or Description
StartTimeWorkday	Time that begins to distribute from the base.
EndTimeWorkday	Cut-off time at which you must arrive at base.
Location	Location of the base of origin.
ReturnBase	After the last service return to base (Y – True, N – False)
EndLocation	Location of the destination base. (If not specified, the same as the source is used),
CostFixed	Optional. Fixed costs when using this vehicle.
CostKm	Optional. Kilometric cost of the vehicle (diesel, wear, etc.)
CostHour	Cost per hour of operation (driver, companion hours, ...)
CostOvertime	Cost of extra hours of operation (driver, companion hours, ...)
MaxContDrivingTime	Optional. Maximum driving time followed without making any stops. Default 23:59:55 hours.
MandatoryBreak	Optional Rest time if the maximum number of consecutive driving is exceeded. Default value 0.
WorkBreaks	Optional. Break List
Capability	Optional. List of vehicle features.
Type	Vehicle Type: A – Light B – Light Industrial C – Heavy Industrial
Length	Vehicle length expressed in centimeters (Optional). It is only taken into account in logistics networks for trucks.
Width	Width of the vehicle expressed in centimeters (Optional). It is only taken into account in logistics networks for trucks.
Height	Vehicle height expressed in centimeters (Optional). It is only taken into account in logistics networks for trucks.
Weight	Total vehicle weight expressed in tonnes (Optional). It is only taken into account in logistics networks for trucks.
AxleWeight	Maximum weight on a vehicle axle in tonnes (Optional). It is only taken into account in logistics networks for trucks.
ADR	Dangerous goods transport (Optional, Default: false)Not implemented.
MaxKph	Maximum speed (kph) of vehicle circulation (Optional). It is only taken into account in logistics networks for trucks.
Comments	Commentary.
CapacityUnits<X>	Optional. Maximum number of units of type <X> can be carried. Each type is defined by an integer between 1 and 4. If we only have one type, we can use the CapacityUnits parameter.
InitialUnits<X>	Optional. Number of units of type <X> with which it leaves the base. If we only have one type we can use the InitialUnits parameter.
MaxDailyKM	Maximum number of daily mileage. (Optional)
Priority	Priority to select this vehicle to perform the services over the others (Optional).
OvertimeUnits	Number of minutes of an after-hours work unit (Optional).
LimitOvertimeBefore	Maximum number of minutes of work before the working day (Optional).
LimitOvertimeAfter	Maximum number of minutes of work after the working day (Optional).
UnloadBases	List of download bases (Optional).
ReloadBases	List of charging bases (Optional).
UnloadBase	Discharge base (Optional). It only allows you to specify a download base. Deprecated.

Parameters inside the vehicle:

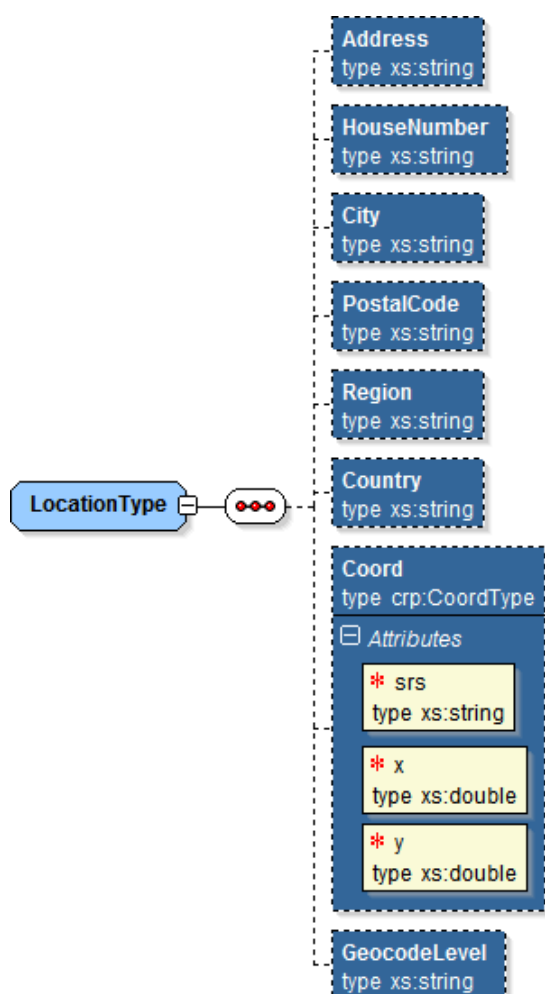


TypeIBIRD	IBIRD Vehicle Type (Optional).
-----------	--------------------------------

```

<Comments></Comments>
<Parameters>
  <Name>TypeIBIRD</Name>
  <Value>xxxx</Value>
</Parameters>
  
```

Description of a Location:



Address	Address
HouseNumber	Portal number (if available separately from the address)
City	City.
PostalCode	Zip code.
Region	Province
Country	Country. It is recommended to put the 3-digit ISO code, for example: ESP (Spain), PRT (Portugal), or FRA (France).
Coord	Location coordinates.

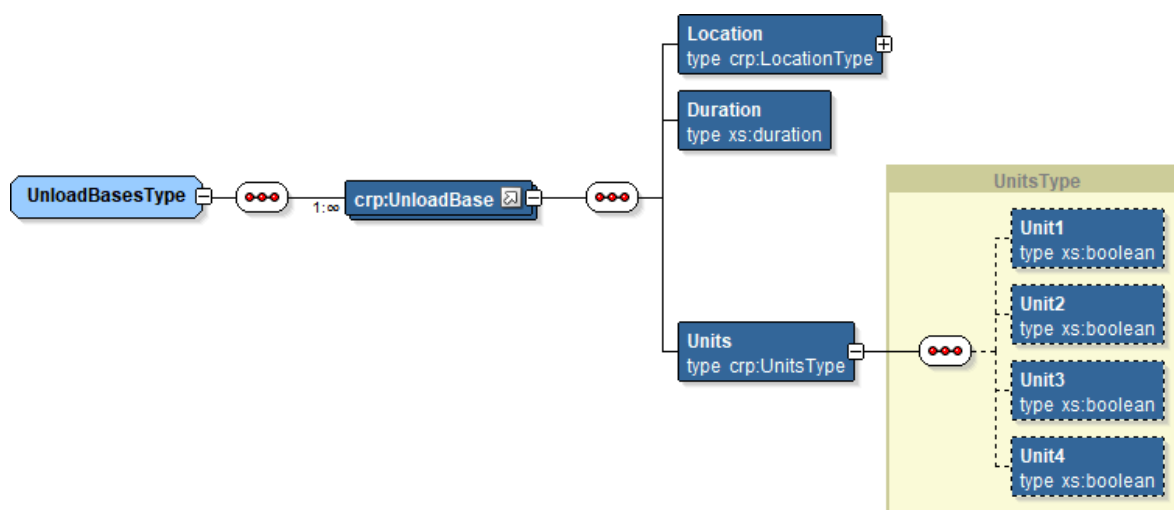
Description of the Location coordinates:

srs	Spatial reference code.
x	X Coordinate or Latitude.
and	Y Coordinate or Longitude.

Description of a WorkBreak:

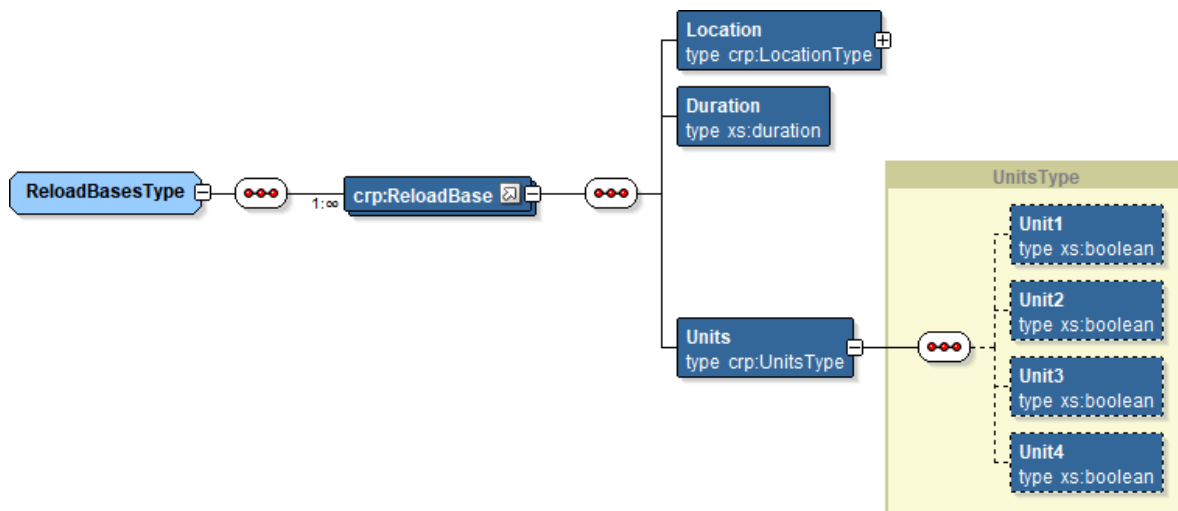
Start	Time from which the break can begin.
end	Time at which the break should have ended.
Duration	Duration of rest.
Comments	Comment/description of the break.

Description of the download bases



Location	Place of unloading.
Duration	Duration of the download.
Units	For each type of drive whether it is unloaded on this basis or not. If not specified, all drive types are downloaded.

Description of charging bases



Location	Place of recharging.
Duration	Duration of recharging.
Units	For each type of unit whether it is recharged on this base or not. If they are not specified, all types of units are reloaded.

Example:

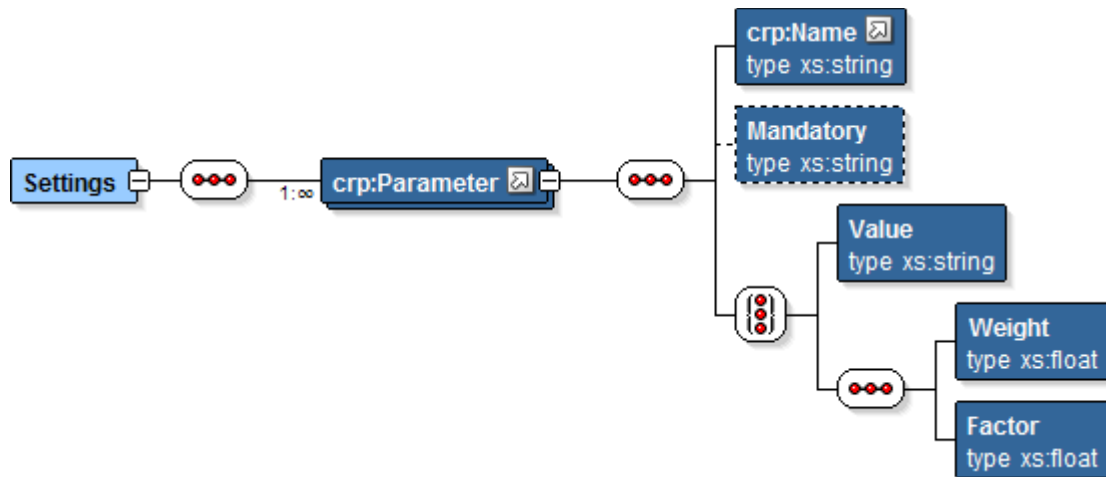
```

<Vehicle>
  <ID>1||2019-10-03</ID>
  <Name>Car 1</Name>
  <StartTimeWorkday>2019-10-03T09:00:00</StartTimeWorkday>
  <EndTimeWorkday>2019-10-03T20:00:00</EndTimeWorkday>
  <Location>
    <Address>Calle de las Cajas</Address>
    <HouseNumber>9</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28043</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.6598712147955483" y="40.45739390916421"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </Location>
  <ReturnBase>Y</ReturnBase>
  <EndLocation>
    <Address>Calle de las Ca&#241; as</Address>
    <HouseNumber>9</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28043</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.6598712147955483" y="40.45739390916421"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </EndLocation>
  <CostFixed>20.0</CostFixed>
  <CostKm>0.7</CostKm>
  <CostHour>20.0</CostHour>
  <CostOvertime>30.0</CostOvertime>
  <MaxContDrivingTime>04:30:00</MaxContDrivingTime>
  <MandatoryBreak>00:45:00</MandatoryBreak>
  <WorkBreaks>
    <WorkBreak start="2019-10-03T13:00:00" end="2019-10-03T15:00:00"
      duration="PT1H0M0S"/>
  </WorkBreaks>
  <Capability>1,2,3,4</Capability>
  <Type>A</Type>
  <Comments>Comment</Comments>
</Vehicle>

```

3.1.3 Specifying the Configuration

A) Planning Configuration:



List of parameters:

Planner	VR: An optional parameter, which activates a faster version of the scheduler, and with a maximum limit of 1,200 services (if this parameter is not specified, the scheduler has a maximum limit of 600 services). Limitations of this version of the scheduler: • The maximum limit of the priority value is 100. • It does not support the use of vehicle capability parameters. • Not compatible with maximum continuous driving time limitation • Not supported for service bundling
Priority	Importance of attending to services with higher priority over those with less priority. Weight: Importance of the priority cost with respect to other factors. Factor: Economic value of performing a service of one priority unit. If the factor is low, there may be services that are not performed simply because performing them is more expensive than the benefit obtained.
Cost	Weight: Importance of vehicle costs with respect to other factors. Factor: Economic value of a unit of cost.
Delay	Mandatory: If after-hours deliveries are not allowed or not. Weight: Importance of the delay with respect to the other factors. Factor: Assessment of the economic cost for after-hours

	deliveries. E.g.: Customer call, loss of prestige, etc ...
AvoidOvertime	'Y' – No overtime allowed 'N' - Overtime is allowed.
AvoidExtraDriving	'Y' - No driving is allowed for more hours in a row than allowed 'N' - Driving is allowed for more hours in a row than allowed.
Allocate	Mandatory: If the load must be distributed among the vehicles. Weight: Importance given to the distribution of workload among vehicles. Factor: economic cost corresponding to each solution for distributing the workload between the vehicles.
AllocateMode	Method of distributing services: • NumberOfServices: Distribute to balance the number of services. • LoadDistribution: Distribute to balance the load of vehicles. • Work: Distribute to balance the workload of the vehicles. Default: Work
GroupServices	It favours the compaction of services, especially in urban environments, to avoid crossing routes. It is important that nearby services are served by the same vehicle. Mandatory: If service grouping is applied. Weight: Importance given to the grouping of nearby services. Factor: Valuation of the grouping cost.
GroupServicesMaxMeters	Maximum number of meters to consider that two services are close.
Network	Network to use – Optional. If not specified, the system will automatically choose the network to use. See Annex with list of available countries
RouteWeight	Weight to minimize when calculating routes. • Time: Optimization by time. • distance: optimization by distance. • sptime: only valid if the SpeedProfiles parameter has been activated in the settings settings. If this weight is chosen, in addition to calculating the times using the information from the day and time profiles, the route is also optimized using these profiles. Default: time .
Iterations	Number of iterations of the optimizer. (optional). Default 50.
RestrictToServiceWindow	Defines whether the service duration should be restricted to the delivery window ('Y') or whether only the service start should be within the delivery window ('N'). Default: 'Y'
MaxServiceDelay	Maximum number of minutes delayed/advanced by a service.

OvertimeUnits	Number of minutes of a unit of work after hours.
LimitOvertimeBefore	Maximum number of working minutes before the working day
LimitOvertimeAfter	Maximum number of working minutes after the working day
MaxDiffAllocate	Maximum difference between the minimum and maximum percentage of occupancy of used vehicles over their working hours.
AllVehicles	If active ('Y') try to use all vehicles instead of ('N') minimize the number of vehicles used. Default 'N'.
TimeFactor	It allows you to increase or decrease the travel time with a percentage value. By default 100.
Processors	The number of processors that the Newronia DLL must use. Default 2.
TypeIBIRD	IBIRD request type.
DivideProblem	If true, it runs a clustering algorithm to break the problem down into smaller subproblems. It also distributes the vehicles among the sub-problems. In the iterations, everything is regrouped.
DivideProblemParts	Sets the number of parts the problem is divided into if Divide Problem is enabled.
MinHoursBreak	It indicates the minimum number of working hours to be entitled to a break.
MinServicesBreak	It indicates the minimum number of services that a vehicle has to do to be entitled to a break.
AttendServicesSide	Attend the services on the right: Y – They must be attended to from the right. N – You don't need to attend to them from the right.
JoinServicesWithSameSection	Before optimizing: Y – Services are grouped in the same section. AttendServicesSide option is automatically enabled N – They do not group.
MaxJoinServicesWithSameSection	Maximum number of services that are grouped by the same section. Default: 5.
Geocoding	If activated, it calculates the coordinates of the services and vehicles that do not have them based on the address information. Default: 0 1 – Enable geocoding of locations without coordinates 0 – Does not geocode locations without a coordinate (returns error if one is found).
IgnoreServicesWithGeocodingLevel	Ignore services that have a geocoding level that is worse than or equal to the level listed. These services will always appear in the list of pending services <PendingServices> Geocoding levels: CT – City ST – Street ADR - Portal
SpeedProfiles	Whether time calculation based on day and time profiles should be activated. Only valid on networks prepared for this purpose (currently the default network or ESP). Possible values: true or false . Default, false.

MaxTravelSeconds	Maximum scan time between two services when optimized for time. Default: 14400 seconds (4 hours).
MaxTravelMeters	Maximum scan distance between two services when optimized by distance. Default: 360,000 m (360 km)
DeadEndTurnCost	Penalty for turning on a dead-end street. Avoid using dead-end streets to make U-turns on adjoining streets. If the optimization is done by distance it is specified in meters, if it is optimized by time it is specified in milliseconds. The value indicates up to what extra cost we are willing to assume for not using the dead-end street. Default: 0

XML configuration example:

```

<Settings>
  <Parameter>
    <Name>Priority</Name>
    <Weight>25</Weight>
    <Factor>1000</Factor>
  </Parameter>
  <Parameter>
    <Name>Cost</Name>
    <Weight>20</Weight>
    <Factor>100</Factor>
  </Parameter>
  <Parameter>
    <Name>Delay</Name>
    <Mandatory>Y/N</Mandatory>
    <Weight>10</Weight>
    <Factor>50</Factor>
  </Parameter>
  <Parameter>
    <Name>AvoidOvertime</Name>
    <Mandatory>Y/N</Mandatory>
  </Parameter>
  <Parameter>
    <Name>AvoidExtraDriving</Name>
    <Mandatory>Y/N</Mandatory>
  </Parameter>
  <Parameter>
    <Name>Allocate</Name>
    <Mandatory>Y</Mandatory>
    <Weight>15</Weight>
    <Factor>100</Factor>
  </Parameter>
  <Parameter>
    <Name>RouteWeight</Name>
    <Value>Time</Value>
  </Parameter>
  <Parameter>
    <Name>Iterations</Name>
    <Value>25</Value>
  </Parameter>
  <Parameter>
    <Name>Network</Name>
    <Value></Value>
  </Parameter>
  <Parameter>
    <Name>RestrictToServiceWindow</Name>
    <Value>Y</Value>
  </Parameter>
  <Parameter>
    <Name>MaxServiceDelay</Name>
    <Value>30</Value>
  </Parameter>

```

```

</Parameter>
<Parameter>
  <Name>OvertimeUnits</Name>
  <Value>30</Value>
</Parameter>
<Parameter>
  <Name>LimitOvertimeBefore</Name>
  <Value>30</Value>
</Parameter>
<Parameter>
  <Name>LimitOvertimeAfter</Name>
  <Value>30</Value>
</Parameter>
<Parameter>
  <Name>MaxDiffAllocate</Name>
  <Value>30</Value>
</Parameter>
<Parameter>
  <Name>TimeFactor</Name>
  <Value>110</Value>
</Parameter>
<Parameter>
  <Name>Processors</Name>
  <Value>110</Value>
</Parameter>
<Parameter>
  <Name>TypeIBIRD</Name>
  <Value>V</Value>
</Parameter>

<Parameter>
  <Name>MinServicesBreak</Name>
  <Value>2</Value>
</Parameter>

<Parameter>
  <Name>MinHoursBreak</Name>
  <Value>2</Value>
</Parameter>

<Parameter>
  <Name>DivideProblemParts</Name>
  <Value>2</Value>
</Parameter>

<Parameter>
  <Name>DivideProblem</Name>
  <Value>true</Value>
</Parameter>
<Parameter>
  <Name>Geocoding</Name>
  <Value>1</Value>
</Parameter>
<Parameter>
  <Name>IgnoreServicesWithGeocodingLevel</Name>
  <Value>CT</Value>
</Parameter>
<Parameter>
  <Name>SpeedProfiles</Name>
  <Value>false</Value>
</Parameter>
</Settings>

```

Bear in mind:

Priority: It has to be very high (ex: 1000), rest of values subtract.

Factor: Indicates the conversion factor to cost in euros.

Weight: The sum of all the weights must be 100.

The final optimization criterion:

$$f(s) = PP*FP*Priority - (PC*FC * Cost(s) + PT*FT * Delay + PR*FR * Allocate)$$

3.2 Planning Result Response

In response to a scheduling request, you will receive an XML containing the job ID for subsequent requests or a list of errors.

```
<Response>
  <Job id="XXXX" />
</Response>
```

or in the event of an error, a response is received such as:

```
<Response>
  <Errors>
    <Error code="30002" desc="Internal Server Error" />
  </Errors>
</Response>
```

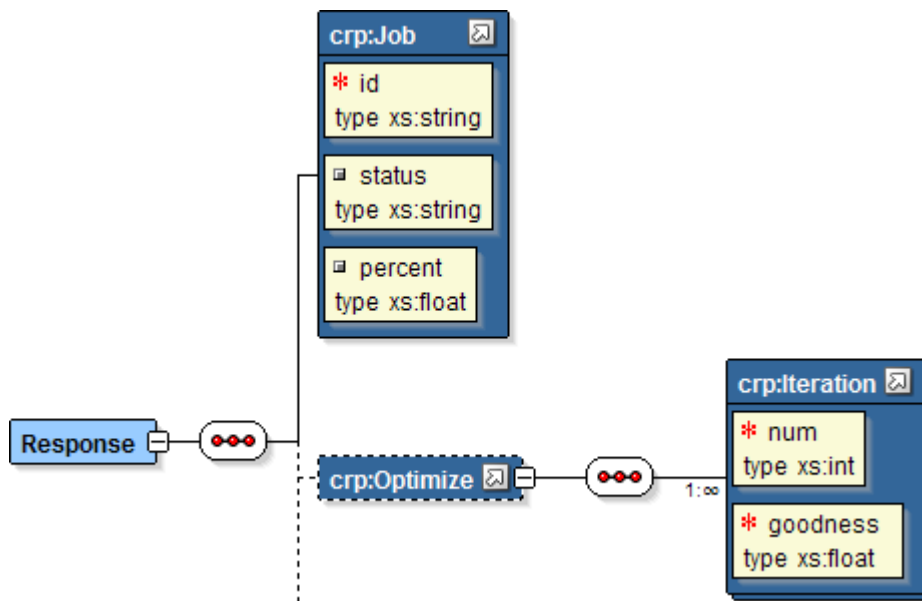
3.3 Requesting the status of a schedule

The status request allows us to check the status of a schedule. If you are in the phase of matrix resolution, planning calculation, error, finished, etc...

Commander	It should always be status .
clientid	Distributor code or distribuidor_cliente. (Required)
client	Client code. (Optional)
Job	Job ID.

3.4 Status result response

A response of the following will be returned:



For example:

```
<Response>
  <Job ID="XXXX" status=" OPTIMIZE" percent ="50.0" />
  <Optimize maxgoodness="122321.32">
    <Iteration num="1" goodness="2331.34" />
    <Iteration num="2" goodness="3531.34" />
  </Optimize>
</Response>
```

or in case of error:

```
<Response>
  <Errors>
    <Error code="30002" desc="Internal Server Error" />
  </Errors>
</Response>
```

The states can be:

QUEUE_MATRIX	In the cost matrix calculation queue.
BUILDING_MATRIX	Calculating cost matrix.
QUEUE_OPTIMIZE	In Queue Calculation Optimizer.
OPTIMIZE	Calculating optimization.
BUILDING_RESPONSE	Building and calculating the answer.
DONATE	Calculation finished.

If the job is in the optimization step, the Optimize tag will be reported. The **maxgoodness** attribute indicates the goodness of the theoretical perfect solution (when the cost of going from one service to another is zero). In each iteration, the goodness of the best solution found is specified.

If the status is **DONE**, a new request must be made to obtain the results of the request.

3.5 Request for cancellation

A job can be canceled at any time.

Commander	It should always be canceled .
-----------	---------------------------------------

clientid	Distributor code or distribuidor_cliente. (Required)
client	Client code. (Optional)
Job	Job ID.

3.6 Cancellation results

If the job is in the Optimization status, the best result obtained so far is returned within the **<Plan> tag**

```
<Response>
  <Job ID="XXXX" status="DONE" percent ="32" />
  <Plan> .... </Plan>
</Response>
```

In case of error:

```
<Response>
  <Errors>
    <Error code="30002" desc="Internal Server Error" />
  </Errors>
</Response>
```

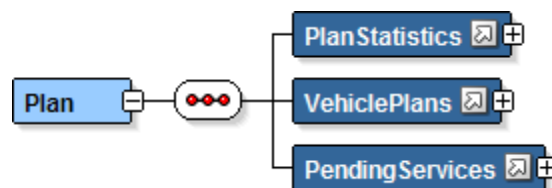
3.7 Request for planning results

The results of a schedule are deleted from the server after X minutes after the schedule has been resolved.

Commander	It must always be result .
clientid	Distributor code or distribuidor_cliente. (Required)
client	Client code. (Optional)
Job	Job ID.

3.8 Response to planning results

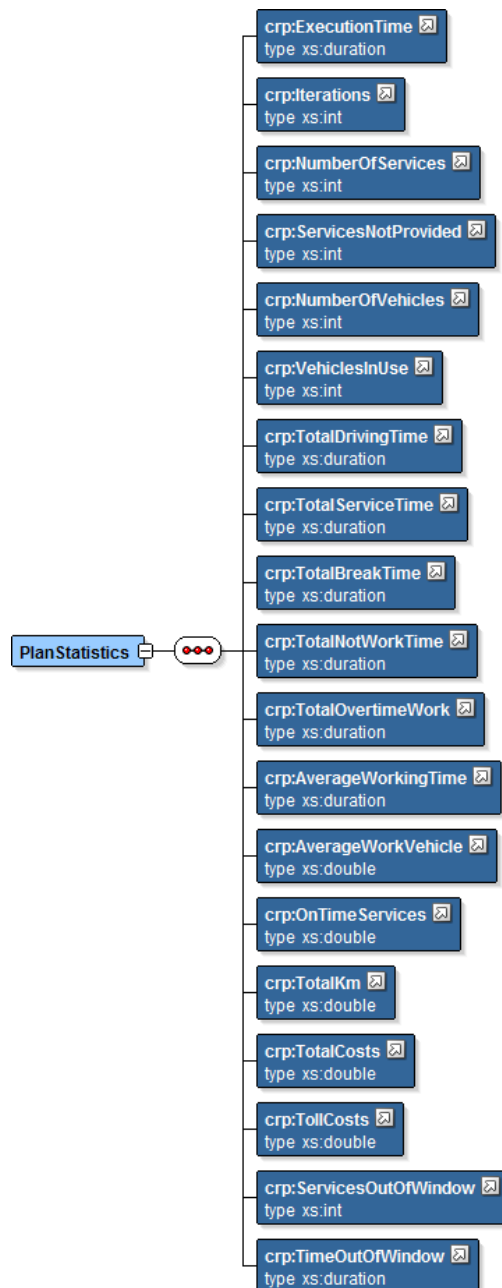
The XML response will be a **<Plan>** consisting of the overall statistics of the plan **<PlanStatistics>**, the vehicles involved in the planning **<VehiclePlans>** and the services that remain to be served **<PendingServices>**



```
<Response>
  <Job ID="XXXX" status="DONE" percent ="100" />
  <Errors>
    <Error code="30002" desc="Internal Server Error" />
  </Errors>
  <Plan> .... </Plan>
```

</Response>

The **overall statistics** of the plan are composed of the following elements:

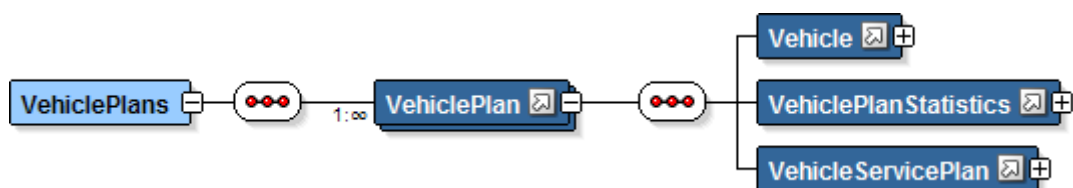


Where

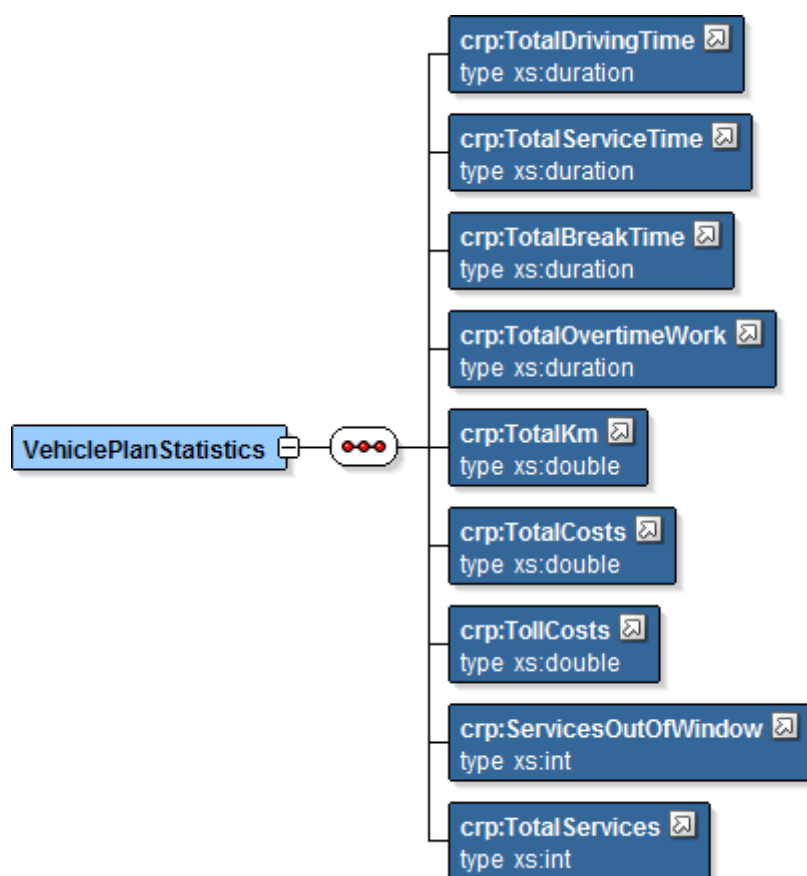
ExecutionTime	Total Calculation Time
Iterations	Number of iterations calculated
NumberOfServices	Total number of services
ServicesNotProvided	Discarded services
TotalServices	Number of services performed.
NumberOfVehicles	Total available vehicles
VehiclesInUse	Total used vehicles
TotalDrivingTime	Total driving time
TotalServiceTime	Total Time in Service
TotalBreakTime	Total Rest Time
TotalNotWorkTime	Total time without any service or breaks, depending on the

	schedule of each vehicle
TotalOvertimeWork	Total overtime work
AverageWorkingTime	Average working and driving time per vehicle used (TotalDrivingTime + TotalServiceTime / VehiclesInUse)
AverageWorkVehicle	Average percentage of work per vehicle, with respect to its schedule, including driving time, time on duty, and established & mandatory breaks.
OnTimeServices	Average percentage of expected punctuality in services: $\text{ServicesOutOfWindow} / (\text{NumberOfServices} - \text{ServicesNotProvided})$
TotalKm	Total Km
ServicesOutOfWindow	Total after-hours services
TimeOutOfWindow	Total cumulative delay of all planned services. Casuistry: Ok (sense retrás)
OrdinaryHoursCosts	Cost of working hours.
OvertimeCosts	Overtime cost.
WorkingCosts	Total cost of hours worked (labor and overtime).
KmCosts	Cost of mileage
TollCosts	Toll costs
TotalCosts	Total cost

<VehiclePlans> is a list of **<VehiclePlan>**. Each **<VehiclePlan>** contains the vehicle data **<Vehicle>**, the vehicle plan statistics **<VehiclePlanStatistics>** and the vehicle service plan **<VehicleServicePlan>**.



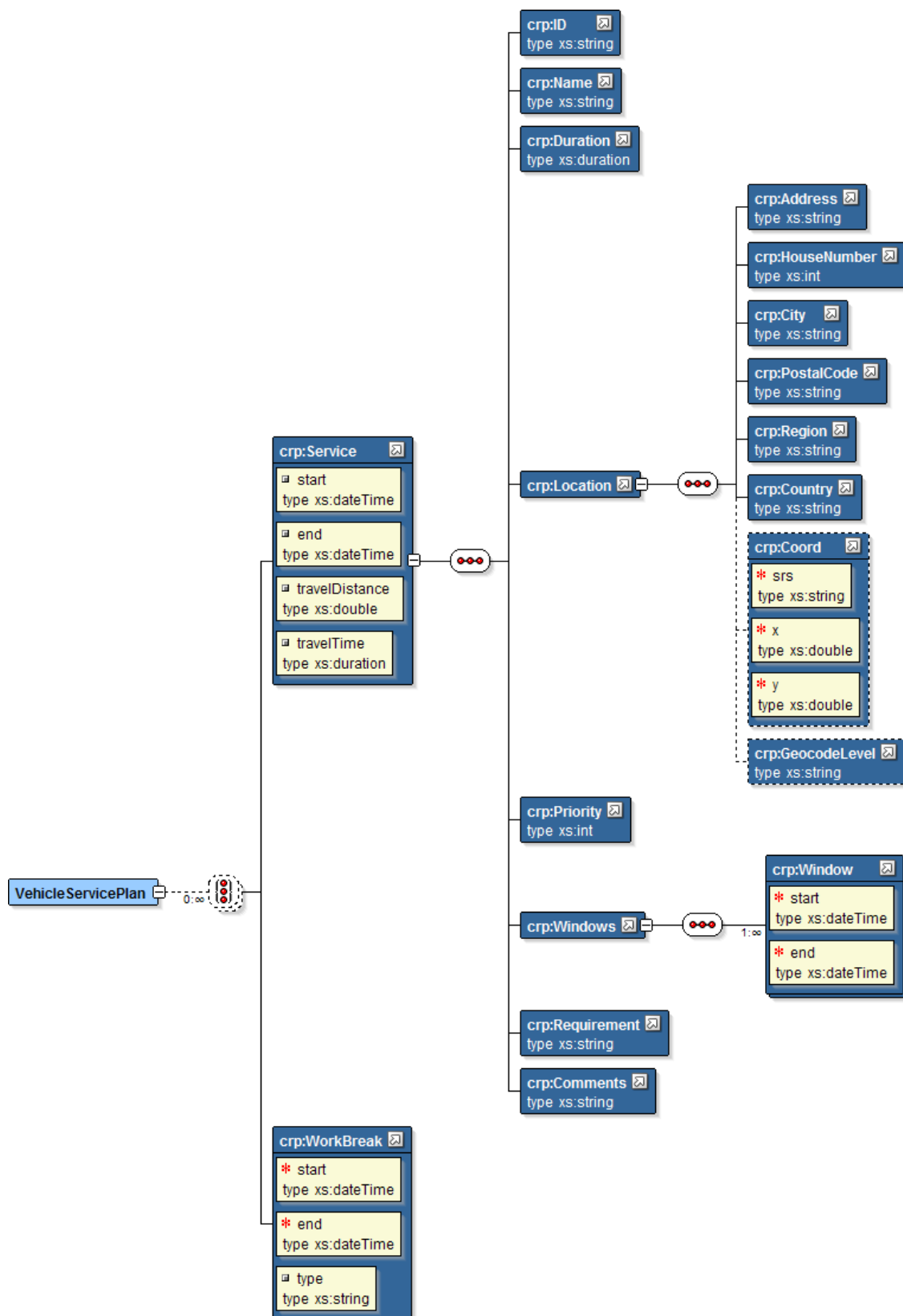
Vehicle Plan Statistics **<VehiclePlanStatistics>** are composed of:



where

TotalDrivingTime	Total driving time
TotalServiceTime	Total Time in Service
TotalBreakTime	Total Rest Time
TotalOvertimeWork	Total overtime work
TotalKm	Total Km
TotalCosts	Total cost
TollCosts	Toll costs
ServicesOutOfWindow	Number of services performed outside of their hours.
TotalServices	Number of services performed.

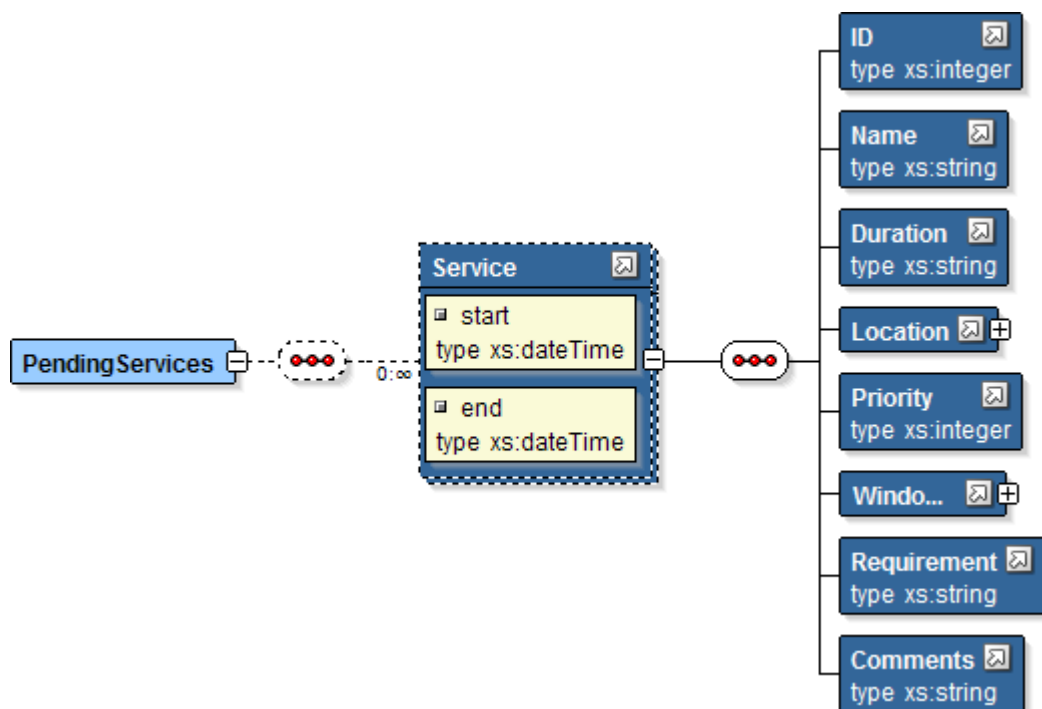
The Vehicle Service Plan <VehicleServicePlan> will consist of a list of services attended <Service> and breaks <WorkBreak> ordered by the date and time of performance. The **start** and **end** attributes of the services will always be informed.



The types of WorkBreak are:

DrivingBreak	Break for exceeding driving time
SpecifiedBreak	Stipulated rest.
BothBreak	The two previous types.
UnloadBreak	Rest for unloading the vehicle.

<PendingServices> provides us with the list of services that are not served.



Example XML output file:

```
<?xml version="1.0" encoding="ISO-8859-1" standalone="yes"?><Response xmlns="http://www.cercalia.com/routeplanner">
  <Plan>
    <PlanStatistics>
      <ExecutionTime>PT0H0M4S</ExecutionTime>
      <Iterations>400</Iterations>
      <NumberOfServices>15</NumberOfServices>
      <ServicesNotProvided>0</ServicesNotProvided>
      <TotalServices>15</TotalServices>
      <NumberOfVehicles>1</NumberOfVehicles>
      <VehiclesInUse>1</VehiclesInUse>
      <TotalDrivingTime>PT1H35M31S</TotalDrivingTime>
      <TotalServiceTime>PT4H55M0S</TotalServiceTime>
      <TotalBreakTime>PT1H0M0S</TotalBreakTime>
      <TotalNotWorkTime>PT3H35M13S</TotalNotWorkTime>
      <TotalOvertimeWork>PT0H0M0S</TotalOvertimeWork>
      <AverageWorkingTime>PT6H30M31S</AverageWorkingTime>
      <AverageWorkVehicle>67.0</AverageWorkVehicle>
      <OnTimeServices>100.0</OnTimeServices>
      <TotalKm>49.451</TotalKm>
      <ServicesOutOfWindow>0</ServicesOutOfWindow>
      <TimeOutOfWindow>PT0H0M0S</TimeOutOfWindow>
      <OrdinaryHoursCosts>148.26111111111112</OrdinaryHoursCosts>
      <OvertimeCosts>0.0</OvertimeCosts>
      <WorkingCosts>148.26111111111112</WorkingCosts>
      <KmCosts>34.6157</KmCosts>
      <TollCosts>0.0</TollCosts>
    </PlanStatistics>
  </Plan>
</Response>
```

```

    <TotalCosts>182.8768</TotalCosts>
  </PlanStatistics>
  <VehiclePlans>
    <VehiclePlan>
      <Vehicle>
        <ID>1||2019-10-03</ID>
        <Name>Salva</Name>
        <StartTimeWorkday>2019-10-03T09:00:00</StartTimeWorkday>
        <EndTimeWorkday>2019-10-03T20:00:00</EndTimeWorkday>
        <Location>
          <Address>Calle de las Cañas</Address>
          <HouseNumber>9</HouseNumber>
          <City>Madrid</City>
          <PostalCode>28043</PostalCode>
          <Region>Madrid</Region>
          <Country>ENP</Country>
          <Coord srs="EPSG:4326" x="-3.6598712147955483" y="40.45739390916421"></Coord>
          <GeocodeLevel>ADR</GeocodeLevel>
        </Location>
        <ReturnBase>Y</ReturnBase>
        <EndLocation>
          <Address>Calle de las Cañas</Address>
          <HouseNumber>9</HouseNumber>
          <City>Madrid</City>
          <PostalCode>28043</PostalCode>
          <Region>Madrid</Region>
          <Country>ENP</Country>
          <Coord srs="EPSG:4326" x="-3.6598712147955483" y="40.45739390916421"></Coord>
          <GeocodeLevel>ADR</GeocodeLevel>
        </EndLocation>
        <CostFixed>0.0</CostFixed>
        <CostKm>0.7</CostKm>
        <CostHour>20.0</CostHour>
        <CostOvertime>30.0</CostOvertime>
        <MaxContDrivingTime>00:00:00</MaxContDrivingTime>
        <MandatoryBreak>00:00:00</MandatoryBreak>
        <WorkBreaks>
          <WorkBreak start="2019-10-03T13:00:00" end="2019-10-03T15:00:00" duration="PT1H0M0S"/>
        </WorkBreaks>
        <Capability></Capability>
        <Comments></Comments>
        <Type>A</Type>
      </Vehicle>
      <VehiclePlanStatistics>
        <TotalDrivingTime>PT1H35M31S</TotalDrivingTime>
        <TotalServiceTime>PT4H55M0S</TotalServiceTime>
        <TotalBreakTime>PT1H0M0S</TotalBreakTime>
        <TotalOvertimeWork>PT0H0M0S</TotalOvertimeWork>
        <TotalKm>49.451</TotalKm>
        <TotalCosts>184.79281111111112</TotalCosts>
        <TollCosts>0.0</TollCosts>
        <ServicesOutOfWindow>0</ServicesOutOfWindow>
        <TotalServices>15</TotalServices>
      </VehiclePlanStatistics>
      <VehicleServicePlan>
        <Begin start="2019-10-03T09:00:00"/>
        <Path distance="7.592" time="PT0H9M35S">
          <Geometry>LINESTRING (-3.6597416295525163 40.4573596452317,...
        </Geometry>
        </Path>
        <Service start="2019-10-03T09:47:09" end="2019-10-03T10:02:09" travelDistance="1.475"
        travelTime="PT0H2M34S">
          <ID>4</ID>
          <Name>Hotel4</Name>
          <Duration>PT0H15M0S</Duration>
          <Location>
            <Address>Calle de Sinesio Delgado</Address>
            <HouseNumber>10</HouseNumber>
            <City>Madrid</City>
            <PostalCode>28029</PostalCode>
            <Region>Madrid</Region>
            <Country>ENP</Country>
            <Coord srs="EPSG:4326" x="-3.6959026408415823" y="40.47506768943292"></Coord>
            <GeocodeLevel>ADR</GeocodeLevel>
          </Location>
          <Priority>1</Priority>
          <Windows>

```

```

        <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="1.691" time="PT0H3M39S">
    <Geometry>LINESTRING (-3.6958846745358995 40.47479328767499,...)</Geometry>
</Path>
<Service start="2019-10-03T10:05:48" end="2019-10-03T10:30:48" travelDistance="1.691"
travelTime="PT0H3M39S">
    <ID>3</ID>
    <Name>Hotel3</Name>
    <Duration>PT0H25M0S</Duration>
    <Location>
        <Address>Calle de Alberdi</Address>
        <HouseNumber>53</HouseNumber>
        <City>Madrid</City>
        <PostalCode>28029</PostalCode>
        <Region>Madrid</Region>
        <Country>ENP</Country>
        <Coord srs="EPSG:4326" x="-3.7068800536135234" y="40.468907097863024"></Coord>
        <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
        <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="3.598" time="PT0H8M3S">
    <Geometry>LINESTRING (-3.7068166035314154 40.468896787552666, ...)</Geometry>
</Path>
<Service start="2019-10-03T10:38:51" end="2019-10-03T10:53:51" travelDistance="3.598"
travelTime="PT0H8M3S">
    <ID>14</ID>
    <Name>Hotel14</Name>
    <Duration>PT0H15M0S</Duration>
    <Location>
        <Address>Complutense Avenue</Address>
        <HouseNumber>34</HouseNumber>
        <City>Madrid</City>
        <PostalCode>28040</PostalCode>
        <Region>Madrid</Region>
        <Country>ENP</Country>
        <Coord srs="EPSG:4326" x="-3.7269663833664355" y="40.453194325165725"></Coord>
        <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
        <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="2.629" time="PT0H5M39S">
    <Geometry>LINESTRING (-3.7264723099601698 40.45262475337097, ...)</Geometry>
</Path>
<Service start="2019-10-03T10:59:30" end="2019-10-03T11:24:30" travelDistance="2.629"
travelTime="PT0H5M39S">
    <ID>11</ID>
    <Name>Hotel11</Name>
    <Duration>PT0H25M0S</Duration>
    <Location>
        <Address>Calle Maestro Ángel Llorca</Address>
        <HouseNumber>8</HouseNumber>
        <City>Madrid</City>
        <PostalCode>28003</PostalCode>
        <Region>Madrid</Region>
        <Country>ENP</Country>
        <Coord srs="EPSG:4326" x="-3.7137701318427196" y="40.44416981440885"></Coord>
        <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
        <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>

```

```

    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
  </Service>
  <Path distance="0.242" time="PT0H0M52S">
    <Geometry>LINESTRING (-3.714097905296463 40.44418813795899, ..)</Geometry>
  </Path>
  <Service start="2019-10-03T12:31:15" end="2019-10-03T12:51:15" travelDistance="4.581"
travelTime="PT0H9M46S">
    <ID>13</ID>
    <Name>Hotel13</Name>
    <Duration>PT0H20M0S</Duration>
    <Location>
      <Address>Calle de Elvira</Address>
      <HouseNumber>24</HouseNumber>
      <City>Madrid</City>
      <PostalCode>28028</PostalCode>
      <Region>Madrid</Region>
      <Country>ENP</Country>
      <Coord srs="EPSG:4326" x="-3.665422803251407" y="40.42240988996007"></Coord>
      <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
      <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
  </Service>
  <Path distance="6.058" time="PT0H8M27S">
    <Geometry>LINESTRING (-3.665309524259872 40.422423323917926 ...)</Geometry>
  </Path>
  <Service start="2019-10-03T12:59:42" end="2019-10-03T13:14:42" travelDistance="6.058"
travelTime="PT0H8M27S">
    <ID>12</ID>
    <Name>Hotel12</Name>
    <Duration>PT0H15M0S</Duration>
    <Location>
      <Address>Calle de Valdebernardo</Address>
      <HouseNumber>24</HouseNumber>
      <City>Madrid</City>
      <PostalCode>28030</PostalCode>
      <Region>Madrid</Region>
      <Country>ENP</Country>
      <Coord srs="EPSG:4326" x="-3.6310352941753115" y="40.40317699806914"></Coord>
      <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
      <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>
  </Service>
  <Path distance="3.632" time="PT0H7M0S">
    <Geometry>LINESTRING (-3.631556317040101 40.40317699806898...)</Geometry>
  </Path>
  <Service start="2019-10-03T13:21:42" end="2019-10-03T13:41:42" travelDistance="3.632"
travelTime="PT0H7M0S">
    <ID>7</ID>
    <Name>Hotel7</Name>
    <Duration>PT0H20M0S</Duration>
    <Location>
      <Address>Saxony Street</Address>
      <HouseNumber>3</HouseNumber>
      <City>Madrid</City>
      <PostalCode>28022</PostalCode>
      <Region>Madrid</Region>
      <Country>ENP</Country>
      <Coord srs="EPSG:4326" x="-3.606708916281355" y="40.42231377360837"></Coord>
      <GeocodeLevel>ADR</GeocodeLevel>
    </Location>
    <Priority>1</Priority>
    <Windows>
      <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
    </Windows>
    <Visits>1</Visits>
    <DistanceBetweenVisits>1</DistanceBetweenVisits>

```

```

</Service>
<Path distance="2.759" time="PT0H6M4S">
  <Geometry>LINESTRING (-3.6068593005209735 40.42225786044621 ...)</Geometry>
</Path>
<Service      start="2019-10-03T13:47:46"      end="2019-10-03T13:57:46"      travelDistance="2.759"
travelTime="PT0H6M4S">
  <ID>2</ID>
  <Name>Hotel2</Name>
  <Duration>PT0H10M0S</Duration>
  <Location>
    <Address>Calle de Lucano</Address>
    <HouseNumber>15</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28022</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.6106435372257986" y="40.43981839722977"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </Location>
  <Priority>1</Priority>
  <Windows>
    <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
  </Windows>
  <Visits>1</Visits>
  <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="3.36" time="PT0H6M45S">
  <Geometry>LINESTRING (-3.610760318212734 40.439585032452854, ...)</Geometry>
</Path>
<Service      start="2019-10-03T15:52:56"      end="2019-10-03T16:02:56"      travelDistance="4.52"
travelTime="PT0H10M31S">
  <ID>10</ID>
  <Name>Hotel10</Name>
  <Duration>PT0H10M0S</Duration>
  <Location>
    <Address>Calle de Valdespina</Address>
    <HouseNumber>4</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28043</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.64139286940121" y="40.466128470979044"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </Location>
  <Priority>1</Priority>
  <Windows>
    <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
  </Windows>
  <Visits>1</Visits>
  <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="0.734" time="PT0H1M51S">
  <Geometry>LINESTRING (-3.641141477082893 40.46612400579821 ...)</Geometry>
</Path>
<Service      start="2019-10-03T16:04:47"      end="2019-10-03T16:24:47"      travelDistance="0.734"
travelTime="PT0H1M51S">
  <ID>5</ID>
  <Name>Hotel5</Name>
  <Duration>PT0H20M0S</Duration>
  <Location>
    <Address>Calle de Alcorisa</Address>
    <HouseNumber>2</HouseNumber>
    <City>Madrid</City>
    <PostalCode>28043</PostalCode>
    <Region>Madrid</Region>
    <Country>ENP</Country>
    <Coord srs="EPSG:4326" x="-3.6417701618205403" y="40.46381629067312"></Coord>
    <GeocodeLevel>ADR</GeocodeLevel>
  </Location>
  <Priority>1</Priority>
  <Windows>
    <Window start="2019-10-03T09:00:00" end="2019-10-03T18:00:00"/>
  </Windows>
  <Visits>1</Visits>
  <DistanceBetweenVisits>1</DistanceBetweenVisits>
</Service>
<Path distance="2.656" time="PT0H5M44S">

```

```

        <Geometry>LINESTRING (-3.6415690301789274 40.463777101599106 ...)</Geometry>
    </Path>
    <End start="2019-10-03T16:30:31" travelDistance="2.656" travelTime="PT0H5M44S"/>
</VehicleServicePlan>
</VehiclePlan>
</VehiclePlans>
<PendingServices/>
<Settings>
    <Parameter>
        <Name>Priority</Name>
        <Weight>25.0</Weight>
        <Factor>1000.0</Factor>
    </Parameter>
    <Parameter>
        <Name>Cost</Name>
        <Weight>25.0</Weight>
        <Factor>1.0</Factor>
    </Parameter>
    <Parameter>
        <Name>Delay</Name>
        <Mandatory>N</Mandatory>
        <Weight>25.0</Weight>
        <Factor>0.3</Factor>
    </Parameter>
    <Parameter>
        <Name>AvoidOvertime</Name>
        <Value>Y</Value>
    </Parameter>
    <Parameter>
        <Name>AvoidExtraDriving</Name>
        <Value>N</Value>
    </Parameter>
    <Parameter>
        <Name>Allocate</Name>
        <Mandatory>N</Mandatory>
        <Weight>25.0</Weight>
        <Factor>0.5</Factor>
    </Parameter>
    <Parameter>
        <Name>Iterations</Name>
        <Value>400</Value>
    </Parameter>
    <Parameter>
        <Name>RouteWeight</Name>
        <Value>Money</Value>
    </Parameter>
    <Parameter>
        <Name>MaxServiceDelay</Name>
        <Value>10</Value>
    </Parameter>
    <Parameter>
        <Name>MaxDiffAllocate</Name>
        <Value>25</Value>
    </Parameter>
    <Parameter>
        <Name>OvertimeUnits</Name>
        <Value>30</Value>
    </Parameter>
    <Parameter>
        <Name>LimitOvertimeBefore</Name>
        <Value>20</Value>
    </Parameter>
    <Parameter>
        <Name>LimitOvertimeAfter</Name>
        <Value>20</Value>
    </Parameter>
    <Parameter>
        <Name>TimeFactor</Name>
        <Value>1</Value>
    </Parameter>
</Settings>
</Plan>
</Response>

```

4 Route matrix

4.1 Route Matrix Calculation Request

The request can be made by GET or POST indicating the following parameters:

Commander	It must always be a matrix .
clientid	Distributor code or distribuidor_cliente.
client	Client code.
srs	Coordinate reference system.
routeweight	Weight to minimize (time, distance, realtime*) *Only on networks that support it
maxcost	Maximum cost of the route returned over the minimized weight. If this cost is exceeded, a -1 will be displayed. Default: No limit.
Network	Network to use (Depending on selected country)
origs	Coordinates points of origin [X0,Y0],[X1,Y1], [Xn,Yn]
dests	Destination point coordinates [X0,Y0],[X1,Y1], [Xn,Yn]
avoidTolls	If it has a value of true , the use of toll roads will be avoided. Default false.
ignoreStopsNotSolved	If it has a value of false , in the event that there is a point (in the sources or destinations) without any nearby network legs, an error will be returned. Default. If it has a value of true , in the event that there is a point (in the sources or destinations) without any nearby network section, the array will still be returned. In the column or row associated with this point, all the values at -1 will appear.
Direction	It determines the sense(s) through which one leaves or arrives at the origins or destinations. DIRECTION_BOTH : you can get there or leave both ways (optimal) DIRECTION_UNRESOLVED : you arrive or leave leaving the origin or destination on the right if possible. DIRECTION_DEFAULT : Default. If it is a street that is not very crowded, both directions are chosen. If it is important, choose the one where the stop is on the right (whenever possible). Other values that should not be used: DIRECTION_FORWARD : It always goes in the same direction as the digitalisation of the section. DIRECTION_BACKWARD : You always arrive in the opposite direction to the digitalisation of the section.

If the **dests** parameter is not specified , an array is calculated across all sources.

If the request is longer than 256 characters, it must be made by POST.

Example of a request:

```
cmd=matrix&clientid=cli&srs=EPSG:4326&routeweight=time&origs=[2.00854781,41.31808218],[1.69725889,41.34549167]
```

4.2 Request for Speed Profiles Route Matrix Calculation

For networks with Speed Profiles support, in addition to the parameters of point 4.1, the following can be specified:

speedProfiles	Default false . If true, travel times are calculated based on the departure time.
departureTime	Date and time of output in ISO 8601 format. Example for UTC time: 2007-04-05T14:30:12Z Only considered with speed profile networks

Example call:

```
cmd=matrix&clientid=xxxxx&srs=EPSG%3A4326
&origs=%5B2.825253%2C+41.970376%5D&dests=%5B2.153909%2C+41.387005%5D&network=ESP&routeweight=sptime&departuretime=2021-03-29T16%3A09%3A08.000Z
```

4.3 Request for calculation of the logistics route matrix

For logistics networks, in addition to the parameters in point 4.1, the following can be specified:

vmaxvel	Maximum vehicle speed expressed in Km/h (Optional)
vweight	Vehicle weight expressed in tonnes. (Optional)
Vaxleweight	Maximum weight of the vehicle's axles expressed in tonnes. (Optional)
vheight	Maximum height of the vehicle expressed in metres. (Optional)
Vlength	Length of the vehicle expressed in metres. (Optional)
vwidth	Width of the vehicle expressed in meters. (Optional)
routeweight	You can specify one of the following: - time: Time - distance: Distance - timerimp: Time (route optimized for ADR vehicles)

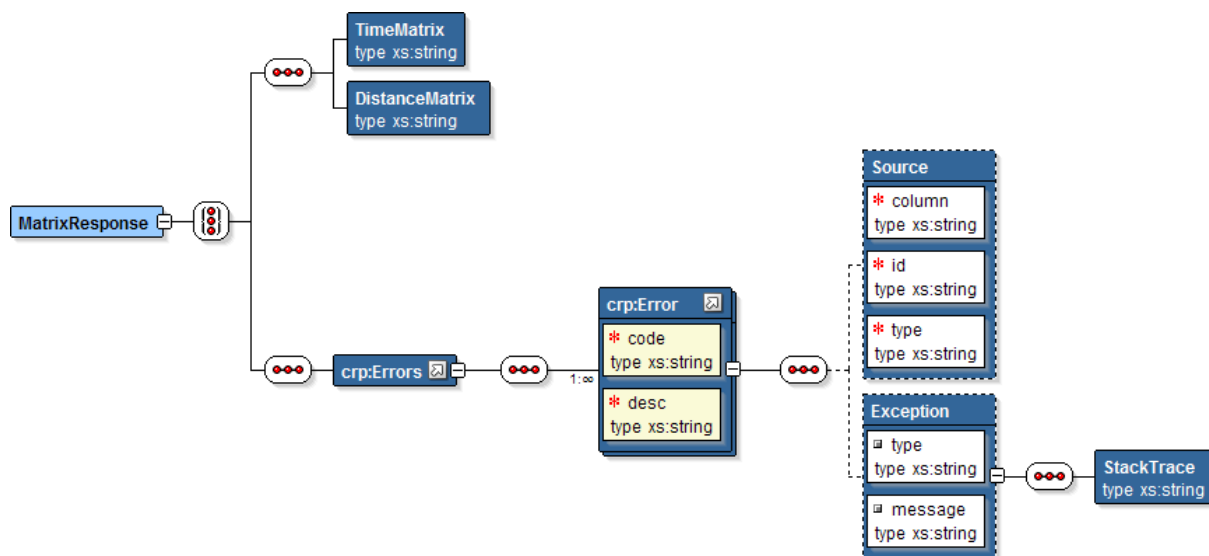
RoutingReparto logistics networks end with the suffix "_logistics"

Example call:

cmd=matrix&clientid=XXXXX&srs=EPSG%3A4326&
 origs=%5B2.825253%2C+41.970376%5D&dests=%5B2.153909%2C+41.387005%5
 D&network=ESP_logistics&routeweight=timerimp&vmaxvel=70&vweight=6

4.4 Route Matrix Calculation Response

The answer is an XML document with the following structure:



```
<MatrixResponse>
  <TimeMatrix>0|232|321|0</TimeMatrix >
  <DistanceMatrix>0|5829227|5856304|0</ DistanceMatrix >
  or
  <Errors>
    <Error code="E10001" desc="Missing Distributor/Customer ID." />
  </Errors>
</MatrixResponse>
```

TimeMatrix contains all the times to go from one coordinate to another expressed in seconds.

To calculate the time it takes to go from the coordinate P_i to the coordinate P_j (where i and j indicate the order of the coordinate in the request) the formula $P_i \times \text{Number of coordinates} + P_j$ must be applied.

DistanceMatrix contains all the distances to go from one coordinate to another expressed in meters.

To calculate the distance between the coordinate P_i and the coordinate P_j (where i and j indicate the order of the coordinate in the request) the formula $P_i \times \text{Number of coordinates} + P_j$ must be applied.

In case of errors, I will see the tag **Errors** instead of the tags **TimeMatrix** and **DistanceMatrix**.

Annex 1: Error codes.

List of Error Codes:

Code	Description
E00000	No error
E10001	Missing distributor/customer ID.
E10002	Unknown reseller/customer ID.
E20003	Insufficient points.
E20004	Level not contracted.
E20005	Unauthorized mobile.
E30001	Server not reachable.
E30002	Internal server error.
E30003	Server busy.
E30004	Nearby connection error.
E30005	Resource not available.
E30106	Error calculating matrix.
E40001	Cartography element not found.
E40002	There is no path.
E50001	Required parameter is missing.
E50002	Incorrect or out-of-range parameter value.
E50008	Incorrect request formatting.
E50009	XML validation failed.
E60001	There are no services to attend.
E60002	There are no vehicles to serve.
E60003	There is no work with this identifier.

Annex 2: List of available countries

Code	Description	Network with logistical constraints
ESP (*)	Iberian Peninsula, France and Monaco	✓
ITA	Italy, San Marino	
BNL	Belgium, Netherlands, Luxembourg	
GBR	England, Ireland, Isle of Man	
CHE	Switzerland, Austria, Liechtenstein	
DEU	Germany	
DNK	Denmark	
ROU	Romania, Bulgaria	
ISR	Israel	
TUR	Türkiye	
USA	United States	
MEX	Mexico	
ARG	Argentina, Chile, Uruguay	
BRA	Brazil	
CABBAGE	Colombia	✓
CRI	Costa Rica	
CHL	Chile	✓

(*) Default