MONALISA 2.0 – Activity 1.3
STM Voyage exchange format and architecture

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**Document Status**

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1 Background

The task of the workgroup in sub-activity 1.3 of the MONALISA 2.0 project was to identify the need for a new or improved exchange format for voyage related information covering the operational needs for Sea Traffic Management.

The work group, with its wide range of skills, knowledge and experience, represented by administrations, academia, industry, service providers and research institutes gathered the requirements and outlined a proposal through a number of workgroup sessions autumn 2013 and spring 2014.

The prerequisites for the work was identified and could be summarized as follow:

- No International standard existed, detailed description missing in IMO performance standard and corresponding IEC standards.
- Proprietary format is used by manufacturers and service providers
- Common standard does not exist for Shore based parts i.e. VTS etc.

With the following obvious drawbacks:

- No interoperability between different systems on board
- No possibility to exchange information ship to shore in a unified way
- Additional workload for crew when route is supposed to be used in different systems or operations

2 Objectives

The following objectives were agreed upon:

A common route exchange format should be developed, which supports all processes in the MONALISA 2.0 project i.e. Sea Traffic Management (STM) where the route can be used:

- On board for safe navigation (ECDIS etc.)
- On board for route-schedule-speed optimisation
- By Pilots
- Ashore for Sea Traffic Management services as:
  - Flow management
  - On route navigational assistance
  - Enhanced monitoring
  - Route exchange ship-ship
  - Port CDM
  - Winter navigation
Area management
Automated reporting
SAR

- Ashore for Route optimisation and creation of dynamic routes
- Ashore by other stakeholders who have an interest in the vessels route and schedule (Vetting, Ships-operator, ports…)

The route format should:
- Be open and if possible be aligned with International Standards.
- Allow easy customisation so that project goals can be achieved

3 Other on going work

It was noticed by the working group that work under way in IEC (TC80/MT7) to revise the standard IEC 61174 ed. 3.0 Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results.

The question was; could it be possible to solve the project needs within the new IEC standard? Time was short as TC80/MT7 (technical committee 80/meeting 7) was in its final stage and the CDV (Committee draft for voting) was just a few months away with the following milestones CDV March 2014 and FDIS March 2015.

Thanks to good cooperation through the CIRM (Comité International Radio-Maritime), IEC TC80/MT7 accepted to add additional attributes into the new formal to meet the project needs. The work was done in a very short time.

4 Result

On the 19th of August 2015, IEC adopted edition 4 of the 61174 standard, where Annex S contains the route exchange format. This standardised route exchange format primarily builds on the work in the MONALISA 2.0 project and is divided into three major blocks

- Route General Information
- Route Geometry block
- Route Schedule block

Each block can contain mandatory and optional information
It should also be possible for manufacturer to add own container of information.
5 The route exchange format as proposed to IEC

This section contains the proposal for the route exchange format as it was delivered from the MONALISA 2.0 project to IEC.

DISCLAIMER
This proposal may differ in some parts from the standard that was later adopted by IEC. The format described here below MUST NOT be used for any implementation of the standard. Please refer to www.iec.ch to obtain the IEC 61174 ed. 4 documentation.

5.1 General

This route plan exchange format is intended to be used for many purposes. For example, it can be used on board for route plan exchange between main and backup ECDIS, ECDIS and radar, ECDIS and optimisation systems, etc. Another example of use is between ship and shore where it can be used to inform the shore about the plan of the vessel; the shore can recommend a route, the shore can optimise a route, etc. This route plan exchange format is based on standardising a single route plan. The application level of the sender and receiver is assumed to be able to handle multiple route plans for use cases which require availability of multiple routes, for example alternative route plans for the same voyage or route plans for different purposes. A route plan consists of waypoints. Each waypoint contains information related to the leg from the previous waypoint. Descriptions of route plans are shown in Figures 5.1 and 5.2. The route exchange format is a file containing an XML coded version of the route plan. The XML route exchange file uses the extension .rtz. A description of the RTZ format is given in Clause 5.5. Examples of RTZ format routes are given in Clauses 5.7 and 5.8.

Clause 5.6 gives an XML schema to be met by RTZ route files so that their structure and content can be verified.

NOTE 1: This route exchange format has some limitations for applicability due to the simple geometric mode used. Application for latitudes above 70° may cause significantly different paths over the earth surface between two systems. Application to long legs such as an ocean crossing is subject to differences in the exact path over the earth surface.

NOTE 2: It is recommended that the receiver of the route exchange always performs a check against the chart database and a geometry check before use for navigation purposes.

NOTE 3: Information in addition to the route exchange format will be necessary between third parties to assure the level of accuracy and repeatability required for Track Control System purposes.
NOTE: The distance between waypoints is from WOL to WOL with zero “advance and transfer” or “forwarding distance”.

**Figure 5.1 – Description of route plan – distance between WP 2 and WP 3**

**Figure 5.2 – Description of route plan – leg parameters belonging to WP 3**

### 5.2 RTP Data container

Data containers are standard ZIP archive files used to compress the size of the route exchange files.
The container file .rtzp stores a XML file .rtz, which conforms to the XML schema described in Clause 5.6.

Use of the data container is optional with removable media. In this case the route exchange may be used with or without the data container. When used without the data container the filename of the route exchange is .rtz instead of .rtzp.

NOTE: The filename is the attribute routeName described in 5.5.3.

In addition to the .rtz file a number of free-format files may be placed in the data container. The semantic data link between the XML nodes and files may be documented using a HTTP like scheme "rtz://<URI>", where "<URI>" identifies a file name inside the data container.

For example:

```xml
<extensions>
  <extension manufacturer="Acme" version="2.1" name="AuxRouteInfo-9674F26E-EAFB-4319-AE24-08D5BA69D895">
    <property name="source" value="http://services.acme.com/auto_route/?id=3e891884e620970e5303fd2399427986"/>
    <property name="attachment" value="rtz://assignement-13.04.2013.docx"/>
    <property name="attachment" value="rtz://MFD_original.rt3"/>
  </extension>
</extensions>
```

### 5.3 High-level description of the RTZ format

The logical design of a route consists of three independent units:

- A block with general information about the route
- A block with route geography (geometry) information, which consists of blocks describing individual legs. Legs are listed in the order they appear on the route
- A block that contains a set of route schedules.

Each block can be extended by manufacturers to fit their needs.

### 5.4 Adaptation to third-party extensions

#### 5.4.1 Generic idea

Extended information in most cases refers to the geography (geometry) of a route. There is a need to ensure that:

- For the possibility to keep extensions from different manufacturers in a single file
- That modifying the geography (geometry) of a route shall not result in extensions data bindings being invalid
• That when changing, adding or removing legs, data consistency should not break down due to unknown extensions in codes for a particular manufacturer.

5.4.2 Unique identification of a waypoint

Each waypoint in a route has a unique composite ID. It is assumed that all RTZ extensions use this identifier to link their data to the geography.

The identifier consists of two parts:
ID, which allows the finding of a waypoint in the list
Revision, which allows the determination of modifications of a waypoint since the entry of the data into a file extension.

ID is an integer
Revision is a monotonically increasing integer.

5.4.3 Creation of new waypoints

After creation of the waypoint the revision attribute gets the value of 0.

5.4.4 Change of geographic data for a waypoint

When the data of a waypoint changes, the software should increase the revision number revision, so that third-party software that works with the extension is able to find out that the data to which it is associated is no longer valid.

5.4.5 Waypoint removal

When deleting a waypoint from a route, all the waypoint data including schedule data is deleted and the waypoint numbers within the route are updated.

Responsibility for the extension's data modification is assigned to the manufacturer's code only.

The data that software is not able to recognize (e.g. extensions and options) are written back into the modified file without modification.

It is assumed that the receiver which understands extensions is able to filter out data when reading the route and be able to eliminate the data of extensions related to removed or to non-existent waypoints.
5.5 Detailed RTZ format description

5.5.1 File components

The RTZ file consists of:

- The mandatory XML processing instruction, which allows the specification of the encoding of string data;
- A root node, which includes namespace declarations for XML Schema-instance and RTZ namespaces;
- The version attribute in the format "Major.Minor" (currently "1.0").

The preferred file encoding is UTF-8.

5.5.2 Route node description

This is the only "root" element of the RTZ file. It has one mandatory attribute "version" that contains the version of the RTZ format used during file creation.

Version is specified as a combination of two figures separated with a dot. The first figure corresponds to the major version. It shall be changed in the case of significant modifications to the document structure. Formats with different major versions are incompatible.

The second figure corresponds to the minor version and indicates format changes that do not affect compatibility.

The **Route** node consists of a sequence of the following child nodes:

- **RouteInfo** node that contains basic information on the route
- **Waypoints** node that describes the geographical components of the route
- **Schedules** node that describes calculated schedule and timing defined by a user
- **Extensions** node that allows for extending the format to fit the particular needs of a manufacturer.

---

1 Comité International Radio-Maritime (CIRM) is the international association for marine electronics companies.
### 5.5.3 RoutInfo node description

The **RoutInfo** node provides a place to store information related to the whole route.

Information is stored in the following attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>routeName</td>
<td>name of the route</td>
<td>String</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>routeAuthor</td>
<td>Author of route</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>routeStatus</td>
<td>Status of route</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>validityPeriodStart</td>
<td>Start of validity period</td>
<td>ISO 8601</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>validityPeriodStop</td>
<td>Stop of validity period</td>
<td>ISO 8601</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselName</td>
<td>Ship’s name</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselMMSI</td>
<td>Ship’s MMSI</td>
<td>XXXXXXXXXX</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselIMO</td>
<td>Ship’s IMO number</td>
<td>XXXXXXX</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselVoyage</td>
<td>Number of the voyage</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselDisplacement</td>
<td>Ship’s displacement</td>
<td>Integer</td>
<td>Option</td>
<td>Unit: tons</td>
</tr>
<tr>
<td>vesselCargo</td>
<td>Ship’s cargo</td>
<td>Integer</td>
<td>Option</td>
<td>Unit: tons</td>
</tr>
<tr>
<td>vesselGM</td>
<td>Metacentric height</td>
<td>XX.XX</td>
<td>Option</td>
<td>Metacentric height of the ship for intended voyage. Unit: metres</td>
</tr>
<tr>
<td>optimisationMethod</td>
<td>Route is optimised to meet KPI</td>
<td>String</td>
<td>Option</td>
<td>Could be fixed speed, Lowest Fuel Consumption, Fixed ETA</td>
</tr>
<tr>
<td>vesselMaxRoll</td>
<td>Ship’s max roll angle allowed</td>
<td>XX</td>
<td>Option</td>
<td>Unit: degrees</td>
</tr>
<tr>
<td>vesselMaxWave</td>
<td>Ship significant wave height limit</td>
<td>XX.X</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>vesselMax_Wind</td>
<td>Ship’s max wind speed limit</td>
<td>XX.X</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>vesselSpeedMax</td>
<td>Ship’s max speed</td>
<td>XX.X</td>
<td>Option</td>
<td>Unit: knots, Speed through water</td>
</tr>
<tr>
<td>vesselServiceMin</td>
<td>Ship’s preferred service speed window_min</td>
<td>XX.X</td>
<td>Option</td>
<td>Unit: knots, Speed through water</td>
</tr>
<tr>
<td>vesselServiceMax</td>
<td>Ship’s preferred service speed window_max</td>
<td>XX.X</td>
<td>Option</td>
<td>Unit: knots, Speed through water</td>
</tr>
<tr>
<td>routeChangesHistory</td>
<td>Cause of route change, Originator and Reason</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
</tbody>
</table>
For example:

```xml
<RouteInfo routeName="AROUNDtheSKAGEN"/>
  vesselName="ACME"
  validityPeriodStart="2014-01-03T03:15:00Z"
  validityPeriodStop="2014-01-06T10:15:00Z"
  vesselMMSI="xxxxxxxxx"
  vesselVoyage="xxxx"/>
```

Additionally, the node may contain a child `extension`.

### 5.5.4 Waypoints node description

**The Waypoints** node contains data related to the geometry of the route. As minimum, it shall contain a sequence of **Waypoint** nodes that describe every leg of the route.

The order of the **Waypoint** nodes follows the order of the legs.

Before the sequence of Waypoint nodes it is possible to insert a DefaultWaypoint node, which defines default values of attributes for newly created legs except for the geometry data.

For example:

```xml
<Waypoint id="24" revision="3" radius="0.6">
  <Position lat="53.0513" lon="8.87509"/>
  <Leg starboardXTD="0.2" portsizeXTD="0.1" geometryType="1"/>
</Waypoint>
```

Additionally, the node may contain a child `extensions` node.

### 5.5.5 DefaultWaypoint node description

**The DefaultWaypoint** node allows the definition of default values of attributes for newly created waypoints.

For example:

```xml
<Waypoints>
  <DefaultWaypoint radius="1.4">
    <Leg starboardXTD="0.5" portsizeXTD="0.5" geometryType="0"/>
  </DefaultWaypoint>
</Waypoints>
```

If the DefaultWaypoint node is provided before the sequence of waypoints, then it shall contain values for attributes for newly created waypoints.
For example:

```xml
<Waypoints>
  <DefaultWaypoint radius="1.4">
    <Leg starboardXTD="0.3" portsideXTD="0.3" geometryType="0"/>
  </DefaultWaypoint>

  <Waypoint id="33" rev="1">
    <Position lat="53.0492" lon="8.87731"/>
  </Waypoint>

  <Waypoint id="17" rev="3" radius="0.3">
    <Position lat="53.0513" lon="8.87509"/>
    <Leg starboardXTD="0.4" portsideXTD="0.5" geometryType="1"/>
  </Waypoint>
</Waypoints>
```

Defaults settings for all waypoints

For this waypoint default settings applied

For this waypoint user settings applied:
- Port XTD = 0.5 NM
- Starboard XTD = 0.4 NM
- Turn radius = 0.3 NM
- Geometry type is orthodrome

### 5.5.6 Waypoint node description

The **Waypoint** node contains the geographical description of a leg between waypoints. Information is stored in the following attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Unique identifier</td>
<td>Integer</td>
<td>Mandatory</td>
<td>It does not have to be equal to the index of the</td>
</tr>
<tr>
<td>revision</td>
<td>Waypoint revision</td>
<td>Integer</td>
<td>Option</td>
<td>Index of revision</td>
</tr>
<tr>
<td>name</td>
<td>Waypoint</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>radius</td>
<td>Turn radius</td>
<td>Real</td>
<td>Option</td>
<td>Unit: NM</td>
</tr>
<tr>
<td>position</td>
<td>Geographic point</td>
<td>GM_Point</td>
<td>Mandatory</td>
<td>Unit: degrees</td>
</tr>
<tr>
<td>leg</td>
<td>Leg attributes</td>
<td></td>
<td>Mandatory</td>
<td>Optional for the first waypoint</td>
</tr>
</tbody>
</table>

Position node contains the latitude and longitude of the waypoint.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>lat</td>
<td>Latitude</td>
<td>Real</td>
<td>Mandatory</td>
<td>Unit: degrees with</td>
</tr>
<tr>
<td>lon</td>
<td>Longitude</td>
<td>Real</td>
<td>Mandatory</td>
<td>Unit: degrees with</td>
</tr>
</tbody>
</table>

Leg node contains attributes of the leg associated with the waypoint (see Figure 5.2).

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>starboardXTD</td>
<td>Starboard XTD</td>
<td>Real</td>
<td>Option</td>
<td>Unit: NM with decimal</td>
</tr>
<tr>
<td>portsideXTD</td>
<td>Portside XTD</td>
<td>Real</td>
<td>Option</td>
<td>Unit: NM with decimal</td>
</tr>
<tr>
<td>safetyContour</td>
<td>Planned Safety</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>Attribute</td>
<td>Description</td>
<td>Type</td>
<td>Option</td>
<td>Unit</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------------------</td>
<td>------------------</td>
<td>--------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>safetyDepth</td>
<td>Planned Safety depth</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>geometryType</td>
<td>Geometry type of leg</td>
<td>Enumeration</td>
<td>Option</td>
<td>loxodrome (= rhumb line) or orthodrome (= great circle)</td>
</tr>
<tr>
<td>planSpeedMin</td>
<td>Lowest cruising speed</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots, Speed over ground</td>
</tr>
<tr>
<td>planSpeedMax</td>
<td>Highest allowed speed</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots, Speed over ground</td>
</tr>
<tr>
<td>draughtForward</td>
<td>Static Draught Forward</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>draughtAft</td>
<td>Static Draught Aft</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>staticUKC</td>
<td>Minimum UKC on the leg</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>dynamicUKC</td>
<td>Minimum Dynamic UKC on the leg</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres</td>
</tr>
<tr>
<td>masthead</td>
<td>Height of masthead</td>
<td>Real</td>
<td>Option</td>
<td>Unit: metres Calculated from keel</td>
</tr>
<tr>
<td>legReport</td>
<td>Reporting information</td>
<td>String</td>
<td>Option</td>
<td>Part of annotated route plan</td>
</tr>
<tr>
<td>legInfo</td>
<td>Nice to know</td>
<td>String</td>
<td>Option</td>
<td>e.g. telephone / web / service point Could be relevant in approach to harbour or VTS</td>
</tr>
<tr>
<td>legNote1</td>
<td>Notes regarding the ETD/ETA</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>legNote2</td>
<td>Local remarks</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
</tbody>
</table>

If an optional attribute is absent the appropriate parameter will be taken from the element defaults node. If this parameter is absent in the defaults node, then its value is set to "zero" or "empty", depending on the type of the parameter. For the case when geometryType is absent, this attribute should be considered as "Loxodrome". Additionally, the node may contain a child extensions node.

### 5.5.7 Storing date and time for legs

Date and time parameters that are associated with the corresponding legs are stored as strings of calendar dates and UTC in extended format according to ISO 8601. For example:

```xml
<Schedule id="2" name="Schedule2">
  <Manual>
    <ScheduleElement id="100" etd="2002-11-17T15:25:00Z"/>
    <ScheduleElement id="105" eta="2002-11-17T15:25:00Z"/>
  </Manual>
</Schedule>
```
5.5.8 Schedules node description

The Schedules node contains data on the schedules associated with the route. Children schedule nodes describe the specific schedule. Additionally, the node may contain a child extensions node.

5.5.9 Schedule node description

5.5.9.1 Components

Schedule node consists of a sequence of the following child nodes:

- Manual node that describes user's preferences for the schedule;
- Calculated node that describes schedule calculation results according to user's preferences.

Additionally, the node may contain a child extensions node.

5.5.9.2 Manual node description

Manual node contains a sequence of ScheduleElement nodes that describe time preferences and calculation restrictions for each leg of the route. A waypoint should not have more than one associated ScheduleElement within a Manual node. Additionally, the node may contain a child extensions node.

5.5.9.3 Calculated node description

Calculated node contains a sequence of ScheduleElement nodes that store calculations results according to user's preferences. A waypoint should not have more than one associated ScheduleElement within a Calculated node. Additionally, the node may contain a child extensions node.

5.5.9.4 ScheduleElement (manual/calculated) node description

ScheduleElement node stores a number of time oriented values related to the route leg (N-1, N), where N is a zero-based index of the leg in the list. Information is stored in the following attributes:
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>waypointID</td>
<td>Identifier of waypoint</td>
<td>Integer</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>etd</td>
<td>Departure time</td>
<td>ISO 8601</td>
<td>Option</td>
<td>- HHMM to etd</td>
</tr>
<tr>
<td>etdWindowBefore</td>
<td>Describes the uncertainty of the predicted etd after optimisation</td>
<td>± HH.MM</td>
<td>Option</td>
<td>+ HHMM after etd</td>
</tr>
<tr>
<td>etdWindowAfter</td>
<td>Describes the uncertainty of the predicted etd after optimisation</td>
<td>± HH.MM</td>
<td>Option</td>
<td>+ HHMM after etd</td>
</tr>
<tr>
<td>eta</td>
<td>Arrival time</td>
<td>ISO 8601</td>
<td>Option</td>
<td>- HHMM to eta</td>
</tr>
<tr>
<td>etaWindowBefore</td>
<td>Describes the uncertainty of the predicted eta after optimisation</td>
<td>± HH.MM</td>
<td>Option</td>
<td>+ HHMM after eta</td>
</tr>
<tr>
<td>etaWindowAfter</td>
<td>Describes the uncertainty of the predicted eta after optimisation</td>
<td>± HH.MM</td>
<td>Option</td>
<td>+ HHMM after eta</td>
</tr>
<tr>
<td>stay</td>
<td>Stay time on WP</td>
<td>dd.hh.mm</td>
<td>Option</td>
<td>Length of stop on WP</td>
</tr>
<tr>
<td>speed</td>
<td>Ground speed</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots</td>
</tr>
<tr>
<td>speedWindow</td>
<td>Describes the uncertainty of the predicted speed after optimisation</td>
<td>± x.xx</td>
<td>Option</td>
<td>Unit: knots - x.xx knots to + x.xx knots</td>
</tr>
<tr>
<td>windSpeed</td>
<td>True wind speed</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots</td>
</tr>
<tr>
<td>windDirection</td>
<td>True wind direction</td>
<td>Real</td>
<td>Option</td>
<td>Unit: degrees</td>
</tr>
<tr>
<td>currentSpeed</td>
<td>Current speed</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots</td>
</tr>
<tr>
<td>currentDirection</td>
<td>Current direction</td>
<td>Real</td>
<td>Option</td>
<td>Unit: degrees</td>
</tr>
<tr>
<td>windLoss</td>
<td>Speed loss caused by wind</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots - Calculated during optimisation</td>
</tr>
<tr>
<td>waveLoss</td>
<td>Speed loss caused by wave</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots - Calculated during optimisation</td>
</tr>
<tr>
<td>totalLoss</td>
<td>Total speed loss</td>
<td>Real</td>
<td>Option</td>
<td>Unit: knots - Calculated during optimisation</td>
</tr>
<tr>
<td>rpm</td>
<td>Advised Engine RPM</td>
<td>Integer</td>
<td>Option</td>
<td>Unit: RPM - Calculated during optimisation</td>
</tr>
<tr>
<td>pitch</td>
<td>Advised propeller pitch</td>
<td>Integer</td>
<td>Option</td>
<td>Unit: % - Calculated during optimisation</td>
</tr>
<tr>
<td>fuel</td>
<td>Predicted fuel consumption on leg</td>
<td>Real</td>
<td>Option</td>
<td>Unit: kg - Calculated during optimisation</td>
</tr>
<tr>
<td>relFuelSave</td>
<td>Relative fuel saving after optimisation</td>
<td>Real</td>
<td>Option</td>
<td>Unit: kg - Calculated during optimisation</td>
</tr>
<tr>
<td>absFuelSave</td>
<td>Absolute fuel saving after</td>
<td>Real</td>
<td>Option</td>
<td>Unit: kg</td>
</tr>
</tbody>
</table>
For example:

```xml
<Schedule id="2" name="Schedule2">
  <Manual>
    <ScheduleElement id="100" etd="2002-11-17T15:25:00Z" />
    <ScheduleElement id="105" eta="2002-12-17T15:25:00Z" />
  </Manual>
  <Calculated>
    <ScheduleElement id="100" etd="2002-11-17T15:25:00Z" speed="11.00000000" />
    <ScheduleElement id="105" eta="2002-12-17T15:25:00Z" speed="12.23242000" />
  </Calculated>
  <Extensions>
  </Extensions>
</Schedule>
```

Additionally, the node may contain a child `extensions` node.

### 5.5.10 Extensions node description

The `Extensions` node contains a set of child `extension` nodes, each of which specifies additional information that may be associated with:

- Whole route
- Whole geographical data
- Certain waypoint
- Whole schedules block
- Certain schedule
- Certain schedule element.

### 5.5.11 Extension node description

The `Extension` node contains a set of mandatory attributes that identify the extension and a number of child nodes that may contain arbitrary information. The format of these nodes is beyond the scope of this standard.

If provided, the manufacturer shall include the specification of his extension nodes in the user manual.
The following attributes are used:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>manufacturer</td>
<td>Unique vendor identifier</td>
<td>String</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>name</td>
<td>Extension name</td>
<td>String</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>version</td>
<td>Extension version</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
</tbody>
</table>

An example that illustrates one of the Acme extensions for GMDSS areas is:

```xml
<Extensions>
  <Extension manufacturer="acme" name="GMDSS-96CF94DF-6ADB-4B08-B43F-355F939AF5F8" version="1.3">
    <Point id="77" class="A1" range="20.0"/>
    <Point id="79" class="A1" range="22.0"/>
    <Point id="80" class="A2" range="121.2"/>
  </Extension>
</Extensions>
```

5.6 XML schema to be met by RTZ route files

```xml
<?xml version="1.0" encoding="utf-8"?>

<!--
Route Exchange Format (RTZ)

XML schema
Revision 1.0
Source: IEC 61174 Ed 4.0:2015
-->

<xsd:schema
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.cirm.org/RTZ/1/0"
  targetNamespace="http://www.cirm.org/RTZ/1/0"
  elementFormDefault="qualified">

<xsd:annotation>
  <xsd:documentation>
    RTZ schema version 1.0—for more information on RTZ and this schema, visit http://www.cirm.org/RTZ.

    RTZ uses the following conventions: all coordinates are relative to the WGS84 datum.

    All measurements are in nautical miles unless otherwise specified.
  </xsd:documentation>
</xsd:annotation>
```
<xsd:element name="route" type="Route">
  <xsd:annotation>
    Route is the root element in the XML RTZ file.
  </xsd:annotation>
</xsd:element>

<xsd:complexType name="Route">
  <xsd:sequence>
    <xsd:element name="routeInfo" type="RouteInfo" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        Generic route information.
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="waypoints" type="Waypoints" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        A list of waypoints.
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="schedules" type="Schedules" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        Optional list of schedules.
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        You can add extend RTZ by adding your own elements from another schema here.
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="version" type="xsd:string" use="required" fixed="1.0">
  </xsd:attribute>
</xsd:complexType>
<xsd:documentation>
  Format version (currently "1.0").
</xsd:documentation>
</xsd:annotation>
</xsd:complexType>
<!--
!-- "RouteInfo" element type definition -->
<!--
!--
<xsd:complexType name="RouteInfo">
  <xsd:sequence>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>You can add extend RTZ by adding your own elements from another schema here.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="routeName" type="xsd:string" use="required">
    <xsd:annotation>
      <xsd:documentation>The name of the route.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="routeAuthor" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>The author of route.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="routeStatus" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Status of route.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="validityPeriodStart" type="xsd:dateTime">
    <xsd:annotation>
      <xsd:documentation>Start of validity period in ISO 8601 format.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="validityPeriodStop" type="xsd:dateTime">
    <xsd:annotation>
      <xsd:documentation>Stop of validity period in ISO 8601 format.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselName" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>The name of ship.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselMMSI" type="xsd:nonNegativeInteger">
    <xsd:annotation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
<xsd:documentation>IMO number of ship.</xsd:documentation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="vesselVoyage" type="xsd:string">
<xsd:annotation>
<xsd:documentation>Number of the voyage.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:attribute>
</xsd:annotation>
<xsd:Documentation>Displacement of ship in tons.</xsd:Documentation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="vesselDisplacement" type="xsd:nonNegativeInteger">
<xsd:annotation>
<xsd:documentation>Cargo of ship in tons.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:annotation>
<xsd:Documentation>Metacentric height in metres.</xsd:Documentation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="optimisationMethod" type="xsd:string">
<xsd:annotation>
<xsd:documentation>Route is optimised to meet KPI.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:attribute>
</xsd:annotation>
<xsd:Documentation>Max roll angle of ship allowed in degrees.</xsd:Documentation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="vesselMaxWave" type="LengthType">
<xsd:annotation>
<xsd:documentation>Ship significant wave height limit in metres.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="vesselMaxWind" type="xsd:decimal">
<xsd:annotation>
<xsd:documentation>Max wind speed limit of ship in metres per second.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:attribute name="vesselSpeedMax" type="SpeedType">
<xsd:annotation>
<xsd:documentation>Max speed of ship in knots.</xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:annotation>
</xsd:documentation>
<xsd:Documentation>Max speed of ship in knots.</xsd:Documentation>
<xsd:annotation/>
</xsd:attribute>
<xsd:attribute name="vesselServiceMin" type="SpeedType">
    <xsd:annotation>
        Preferred service speed window minimum in knots.
    </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="vesselServiceMax" type="SpeedType">
    <xsd:annotation>
        Preferred service speed window maximum in knots.
    </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="routeChangesHistory" type="SpeedType">
    <xsd:annotation>
        Cause of route change, originator and reason.
    </xsd:annotation>
</xsd:attribute>
</xsd:complexType>

<!-- -->
<-- "LengthType" element type definition -->
<!-- -->
<xsd:simpleType name="LengthType">
    <xsd:annotation>
        Length type.
    </xsd:annotation>
    <xsd:restriction base="xsd:decimal">
        <xsd:minInclusive value="0.0"/>
    </xsd:restriction>
</xsd:simpleType>

<!-- -->
<-- "SpeedType" element type definition -->
<!-- -->
<xsd:simpleType name="SpeedType">
    <xsd:annotation>
        Speed type.
    </xsd:annotation>
    <xsd:restriction base="xsd:decimal">
        <xsd:minInclusive value="0.0"/>
    </xsd:restriction>
</xsd:simpleType>

<!-- -->
<-- Extension point type definition -->
<!-- -->
<xsd:complexType name="Extensions">
    <xsd:annotation>
        You can add extend GPX by adding your own elements from another schema here.
    </xsd:annotation>
</xsd:complexType>
You can add extend GPX by adding your own elements from another schema here.

```xml
<xs:element name="Waypoint" type="Waypoint" minOccurs="0" maxOccurs="unbounded">
    <xs:annotation>
        <xs:documentation>Waypoint details.</xs:documentation>
    </xs:annotation>
</xs:element>
```

```xml
<xs:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
    <xs:annotation>
        <xs:documentation>You can add extend RTZ by adding your own elements from another schema here.</xs:documentation>
    </xs:annotation>
</xs:element>
```

```xml
<xs:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
    <xs:annotation>
        <xs:documentation>Leg attributes.</xs:documentation>
    </xs:annotation>
</xs:element>
```

```xml
<xs:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
    <xs:annotation>
        <xs:documentation>You can add extend RTZ by adding your own elements from another schema here.</xs:documentation>
    </xs:annotation>
</xs:element>
```
<xsd:element name="radius" type="RadiusType">
  <xsd:annotation>
    <xsd:documentation>Turn radius in NM.</xsd:documentation>
  </xsd:annotation>
</xsd:element>

<xsd:complexType>
  <!-- "RadiusType" element type definition -->
</xsd:complexType>

<xsd:simpleType name="RadiusType">
  <xsd:annotation>
    <xsd:documentation>Radius type.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="0.0"/>
    <xsd:maxExclusive value="10.0"/>
  </xsd:restriction>
</xsd:simpleType>

<xsd:complexType name="Waypoint">
  <xsd:sequence>
    <xsd:element name="position" type="GM_Point" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>Geographic point.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>Leg attributes.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>You can add extend RTZ by adding your own elements from another schema here.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:nonNegativeInteger" use="required">
    <xsd:annotation>
      <xsd:documentation>Unique waypoint identifier.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="revision" type="xsd:nonNegativeInteger">
    <xsd:annotation>
      <xsd:documentation></xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
Waypoint revision. Increased on every change.

```xml
<xs:complexType name="Leg">
  <xs:attribute name="name" type="xsd:string">
    <xs:documentation>Waypoint name.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="radius" type="RadiusType">
    <xs:documentation>Turn radius in NM.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="starboardXTD" type="XtdType">
    <xs:documentation>Starboard XTE in NM.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="portsideXTD" type="XtdType">
    <xs:documentation>Portside XTE in NM.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="safetyContour" type="LengthType">
    <xs:documentation>Safety contour in metres.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="safetyDepth" type="LengthType">
    <xs:documentation>Safety depth in metres.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="geometryType" type="GeometryType">
    <xs:documentation>Geometry type of leg.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="speedMin" type="SpeedType">
    <xs:documentation>Lowest cruising speed in knots.</xs:documentation>
  </xs:attribute>
  <xs:attribute name="speedMax" type="SpeedType">
    <xs:documentation>Highest allowed speed in knots.</xs:documentation>
  </xs:attribute>
</xs:complexType>
```

---

"Leg" element type definition -->

--- -->
<xsd:simpleType name="LengthType">
    <xsd:annotation>
        <xsd:documentation>Static draught forward in metres.</xsd:documentation>
    </xsd:annotation>
</xsd:simpleType>

<xsd:simpleType name="XtdType">
    <xsd:annotation>
        <xsd:documentation>XTD of the point. Nautical miles.</xsd:documentation>
    </xsd:annotation>
</xsd:simpleType>
<xsd:documentation/>
</xsd:annotation>
<xsd:restriction base="xsd:decimal">
  <xsd:minInclusive value="0.0"/>
  <xsd:maxExclusive value="10.0"/>
</xsd:restriction>
</xsd:simpleType>

<!-- "geometry/geopoint" element type definition -->
<!-- -->
<xsd:complexType name="GM_Point">
  <xsd:attribute name="lat" type="LatitudeType" use="required">
    <xsd:annotation>
      <xsd:documentation>Latitude in degrees.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="lon" type="LongitudeType" use="required">
    <xsd:annotation>
      <xsd:documentation>Longitude in degrees.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!-- RL/GC indicator type definition -->
<!-- -->
<xsd:simpleType name="GeometryType">
  <xsd:annotation>
    <xsd:documentation>RL/GC indicator.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="Loxodrome"/>
    <xsd:enumeration value="Orthodrome"/>
  </xsd:restriction>
</xsd:simpleType>

<!-- Geographical latitude type definition -->
<!-- -->
<xsd:simpleType name="LatitudeType">
  <xsd:annotation>
    <xsd:documentation>The latitude of the point. Decimal degrees, WGS84 datum.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="-90.0"/>
    <xsd:maxInclusive value="90.0"/>
  </xsd:restriction>
</xsd:simpleType>

<!-- Geographical longitude type definition -->
<!-- -->
<xsd:simpleType name="LongitudeType">
  <xsd:annotation>
  </xsd:annotation>
</xsd:simpleType>
The longitude of the point. Decimal degrees, WGS84 datum.
You can add extend RTZ by adding your own elements from another schema here.

<!---- -->
<!---- "Manual" element type definition -->
<!---- -->
<xsd:complexType name="Manual">
  <xsd:annotation>
    <xsd:documentation>User defined schedule parameters.</xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="scheduleElement" type="ScheduleElement" minOccurs="1" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>Manual schedule leg definition.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>You can add extend RTZ by adding your own elements from another schema here.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>

<!---- -->
<!---- "Calculated" element type definition -->
<!---- -->
<xsd:complexType name="Calculated">
  <xsd:annotation>
    <xsd:documentation>Calculated schedule parameters.</xsd:documentation>
  </xsd:annotation>
</xsd:complexType>
Calculated schedule waypoint parameters.

You can add extend RTZ by adding your own elements from another schema here.

Unique waypoint identifier.

UTC estimated departure time in ISO 8601 format.

Describes the uncertainty of the predicted ETD after optimisation.
Describes the uncertainty of the predicted ETD after optimisation.

UTC estimated arrival time in ISO 8601 format.

Describes the uncertainty of the predicted ETA after optimisation.

Describes the uncertainty of the predicted ETA after optimisation.

Stay time on WP.

True speed in knots.

Describes the uncertainty of the predicted speed after optimisation in knots.

True wind speed in metres per second.

True wind direction in degrees.

Current speed in knots.
<xsd:simpleType name="CourseType">
    <xsd:annotation>
        <xsd:documentation>Course type in degrees.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:decimal">
        <xsd:minInclusive value="0.0"/>
        <xsd:maxExclusive value="360.0"/>
    </xsd:restriction>
</xsd:simpleType>

5.7 Basic RTZ route example

<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns="http://www.cirm.org/RTZ/1.0" version="1.0"
    xsi:schemaLocation="http://www.cirm.org/RTZ/1.0 rtz.xsd">
    <routeInfo routeName="AROUNDtheSKAGEN"/>
    <waypoints>
        <defaultWaypoint radius="0.1"/>
        <waypoint id="15" revision="1"/>
        <position lat="53.0492" lon="8.87731"/>
        <waypoint id="52" revision="3"/>
        <position lat="53.0513" lon="8.87509"/>
        <leg portsideXTD="0.3" starboardXTD="0.3" safetyContour="11.20000000" safetyDepth="22.20000000" geometryType="Orthodrome"/>
        <waypoint id="1" revision="1" name="To the pier"/>
        <position lat="53.5123" lon="8.11998"/>
        <leg portsideXTD="0.1" starboardXTD="0.1" safetyContour="11.20000000" safetyDepth="22.20000000" geometryType="Orthodrome"/>
        <waypoint id="5" revision="3" name="To the pier"/>
        <position lat="53.0492" lon="8.87731"/>
        <leg portsideXTD="0.1" starboardXTD="0.1" safetyContour="11.20000000" safetyDepth="22.20000000" geometryType="Orthodrome"/>
    </waypoints>
    <schedules>
        <schedule id="1" name="Schedule1">
            <manual>
                <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
                <scheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"/>
            </manual>
            <calculated/>
        </schedule>
        <schedule id="2" name="Schedule2">
            <manual>
                <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
                <scheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"/>
            </manual>
        </schedule>
    </schedules>
</route>
5.8 Example of the RTZ route with embedded extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns="http://www.cirm.org/RTZ/1.0"
      xsi:schemaLocation="http://www.cirm.org/RTZ/1.0 rtz.xsd">
  <routeInfo routeName="AROUNDtheSKAGEN"/>
  <waypoints>
    <defaultWaypoint radius="0.1">
      <leg portsideXTD="0.1" starboardXTD="0.1"/>
    </defaultWaypoint>
    <waypoint id="15" revision="1">
      <position lat="53.0492" lon="8.87731"/>
      <leg portsideXTD="0.1" starboardXTD="0.1"
            safetyContour="11.20000000"
            safetyDepth="22.20000000" geometryType="Loxodrome"/>
    </waypoint>
    <waypoint id="52" revision="3">
      <position lat="53.0513" lon="8.87509"/>
      <leg portsideXTD="0.3" starboardXTD="0.3"
            safetyContour="11.20000000"
            safetyDepth="22.20000000" geometryType="Orthodrome"/>
    </waypoint>
    <waypoint id="1" revision="1" name="To the pier">
      <position lat="53.5123" lon="8.11998"/>
      <leg portsideXTD="0.1" starboardXTD="0.1"/>
    </waypoint>
  </waypoints>
  <schedules>
    <schedule id="1" name="Schedule1">
      <manual>
        <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" speed="11.34520000"/>
        <scheduleElement waypointId="1" etd="2002-11-17T15:25:00Z"/>
      </manual>
      <calculated/>
    </schedule>
    <schedule id="2" name="Schedule2">
      <manual>
        <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
        <scheduleElement waypointId="15" etd="2002-12-17T15:25:00Z" speed="12.66635112"/>
      </manual>
      <calculated>
        <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" speed="11.34520000"/>
      </calculated>
    </schedule>
  </schedules>
</route>
```
<scheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"
    speed="12.66635112">
    <extensions>
        <extension manufacturer="Acme" version="2.1"
            name="Int-681EA94E-C27A-4CCA-A405-98BDA20AA7C6">
            <struct name="xxx">
                <Param name="x" value="y" />
            </struct>
        </extension>
    </extensions>
</scheduleElement>
</calculated>
</extensions>
</schedule>
</schedules>
<extensions>
    <extension manufacturer="Acme" version="1.0"
        name="Internal-C93B70B2-D733-4388-937C-639472E26C6F">
        <waypoint id="15" rev="1" link="rtz://symbols.png"/>
    </extension>
</extensions>
</route>

5.9 UML model of the Route exchange format

Figure 5.3 gives the Unified Modelling Language diagram for the route exchange format.
Figure 5.3 – UML diagram
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