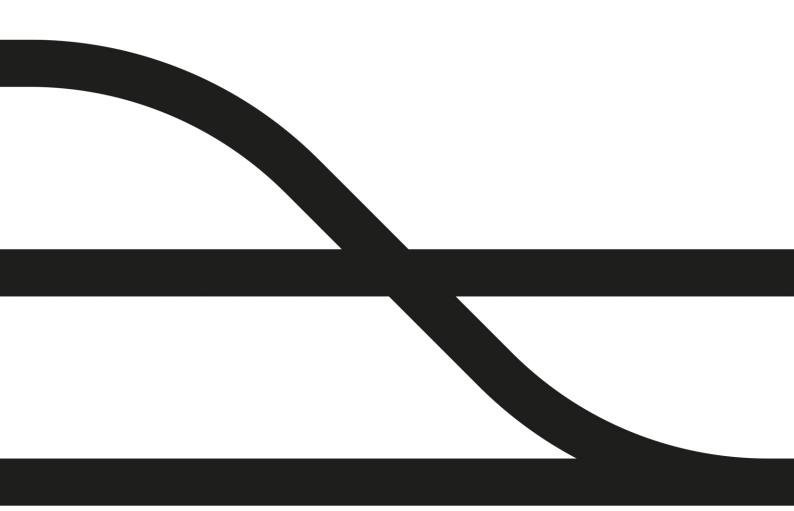# railML2.4nor Documentation

Subschema Timetable

Summary

The following documents the railML2.4nor Timetable schema, especially the Norwegian specialties and resulting extensions to railML2.4. It contains information about the application of railML2.4nor Timetable, general modelling rules and an example with corresponding railML2.4nor source code.

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1 General Information

1.1 What is railML2.4nor

railML2.4nor is an extension of the railway data exchange schema railML version 2.4, addressing specific Norwegian requirements. railML – Railway Markup Language – is an open-source XML based data exchange format, which shall enable an easy communication of heterogenous railway applications. Today, the connection of various railway software packages is beset with problems. The purpose of the railML.org initiative has been to find, discuss and present systematic, XML-based solutions for simplified and standardized data exchange between railway applications. The schema is developed by railML.org, a registered association in Germany since 2002, in close cooperation with all interested institutions and businesses of the railway sector across Europe.[1] railML2.4 consists of three subschemas: Infrastructure, Rollingstock and Timetable.

railML2.4nor is a microscopic model, which consists of a proportion of railML2.4 and adds extensions to meet Norwegian requirements. railML2.4nor does not contain all railML2.4 elements, as not everything in railML2.4 is of relevance for Norwegian railways. railML2.4nor precisely defines rules and conventions - in accordance with Norwegian requirements - for adopted ambiguous elements/attributes, where existing railML documentation is vague or open to interpretation. In other words: railML2.4nor is the Norwegian usage of railML2.4 plus Norwegian extensions. The following diagram shows the relation of railML2.4 and railML2.4nor.

railML2.4

railML2.4 elements, which are used in railML2.4nor. Partly defined more precisely in accordance to Norwegian requirements

Norwegian extensions

railML2.4nor

Figur 1: Relation of railML2.4 and railML2.4nor

[1] (railML.org, 2018)

1.2 Why do we need railML2.4nor?

railML is a multinational development and aims at modelling the reality in the most generic way possible. This requires coordination and discussion with numerous stakeholders and hence is a time-consuming process. Furthermore, its generic characteristic does not allow the implementation of all national requirements. As a result, the railML schema in its original form, currently does not fit Norwegian requirements sufficiently for productive use. Due to this, the Norwegian Sector decided to adjust the schema to meet Norwegian requirements in an extension. The Norwegian sector consists of all companies who work within the railway industry in Norway. Primarily in charge of the development and distribution of railML2.4nor is the Norwegian Railway Directorate Jernbanedirektoratet and the Norwegian infrastructure manager Bane NOR.

The Norwegian sector's aim is to create a data exchange format, which serves as exchange format between various railway applications, tailored to Norwegian requirements.

1.3 What do we use railML2.4nor Timetable for?

The Norwegian railML2.4nor Timetable schema is developed in accordance with the requirements of the following use cases. It shall be used by the Norwegian sector as the general data exchange format in these areas. Information about the scope of the use cases is provided in the railML Wiki. The Norwegian sector uses the schema for the following use cases:

- Long-term strategic timetable,
- Operational timetable,
- Operational simulation timetable,
- Timetable planning for tenders, long-term and short-term plan.

1.4 Reader information

This document is a documentation of the subschema Timetable of the railML2.4nor data exchange format, which is hereafter abbreviated by TT. The documentation of the schemas Rollingstock and Infrastructure for railML2.4nor are located in separate documents and can be found at www.jernbanedirektoratet.no/railml.

This documentation contains general rules and definitions of how ambiguously defined core railML2.4 TT elements are interpreted and modelled in Norway. Furthermore, it addresses Norwegian extensions that were introduced in order to meet national requirements. The Norwegian extensions are always recognizable in the documentation by their "nor:" prefix, e.g. <nor:patternTrain>.

Please note that this document is only a supplement to the documentation of the core railML schema. The documentation of the core railML schema is provided by railML.org and can be found in the following places:

- railML Wiki: Contains information about schema application
- railML Forum: Platform for discussions with railML users and the developer community
- railML Trac Ticket System: Platform to record and track all bugs and model enhancements
- railML.org: Contains general information about the organisation of railML.org, the development of the schema, download of the schema and example data
- railML XSDs

This document refers to the status of documentation of core railML as of 11th May 2020. Any later changes might not have been taken in account in the railML2.4nor TT documentation. In addition to the general modelling rules, this document provides an example of railML2.4nor TT. It consists of the corresponding railML2.4nor source code.

Furthermore, the Norwegian sector provides an Excel sheet listing all railML2.4nor TT elements with their attributes, values and specific definitions. This Excel sheet contains all used railML2.4 TT core elements with their attributes and values, and the extension elements with their attributes and value lists. Please additionally have a look at this Excel sheet, it is the complete overview of all elements, attributes and values of the railML2.4nor TT schema.

The official XSD of railML2.4nor TT can be found on the [Jernbanedirektoratet website](#).

1.5 Syntax guide

In the text, railML <elements> are put into XML specific brackets <>. railML @attributes can be recognized via the @ symbol before the attribute name. The combination of element and attribute is notated <element>@code. When specifying a parent- and a child-element, the syntax is <parent><child>. Attribute "values" are framed by quotation marks "".

Source code examples are written in grey boxes:

```
<railml sourcecode="example">
   ...
</railml>
```

Some information in this document is written in *italic letters*. This means that the information is regarded as additional background information.

1.6 Versioning of railML2.4nor TT documentation

For comprehensibility of changes in the railML2.4nor TT documentation the document has an ongoing version number. Current and previous versions are stated in the table below including a short description of the modifications with regard to the previous version.

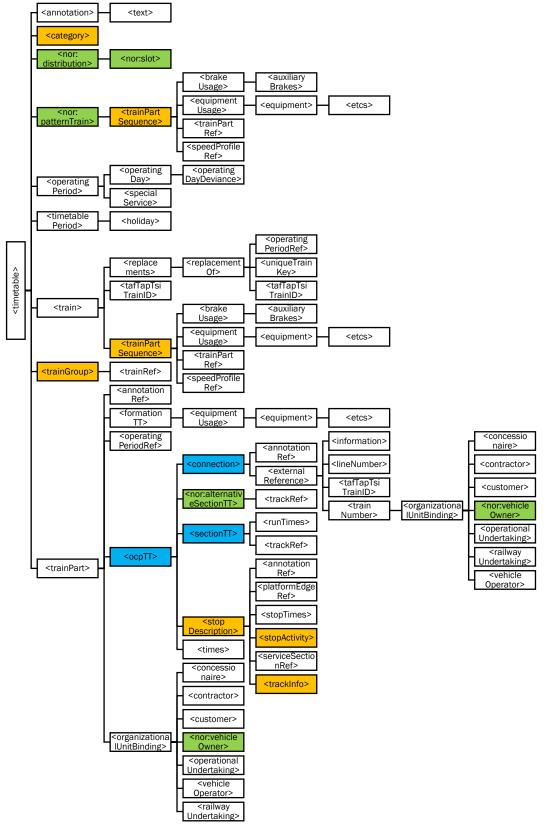| Version	Release date of railML2.4nor TT documentation	Comments
1.0	03.07.2020	First version of railML2.4nor Timetable
1.1	17.12.2020	Changes: - Attribute extension @nor:stopRef removed. Instead: creation of a <stopPost> with @virtual="true" that can be referred to. - Extension of <trackInfo> with @nor:trackRef and @nor:rank - Minor changes in descriptions

2 railML2.4nor TT content on element level

The following hierarchy shows all elements railML2.4nor TT contains. It does not address attributes and values of these elements. Please note that the hierarchy is a simplification of the model and does not show container elements or elements from core railML that are not used in Norway. It is only meant to illustrate the content and does not display the correct syntax. A full list of all elements, attributes and values is given in the Excel sheet – railML2.4nor Timetable Model. Additionally, also view the example at the end of this document and the railML2.4nor Timetable XSD.

The colours in which the rectangles in the hierarchy are coloured have the following meaning:

- Green: These are newly introduced extension elements. They can also be identified by their "nor:" namespace and are not part of the railML2.4 TT core schema.
- Orange: These elements are railML2.4 TT core elements but are extended by Norway specific attributes or values.
- Blue: These elements are railML2.4 TT core elements, which are defined ambiguously by railML and thus were defined more precisely in accordance with Norwegian usage.
- Non-coloured: These elements are railML2.4 TT core elements, which are defined precisely by railML and thus do not need to be defined more precisely for railML2.4nor.

All elements that are coloured in the hierarchy are addressed in this document. A definition of all non-coloured elements is available in the railML wiki. All elements are listed with their – for railML2.4nor - relevant attributes and value sets in the Excel sheet.

Figur 2: Elements contained in railML2.4nor TT

3 General Modelling Rules

The following chapters explain general modelling rules that must be taken into account when working with railML2.4nor TT data.

3.1 Main language

The main language used in railML2.4nor TT is Norwegian. That is to be specified in the sub element <dc:language> of the element <metadata> and applies for all @name and @description attributes of children elements of <timetable>. The value of the unique language identifier <dc:language> complies with the language standard IETF BCP 47, which is described in the railML-wiki. In practice this element will be described in railML in the following way:

```
<dc:language>
    no-NO
</dc:language>
```

If the language of any @name or @description attributes of any element differs from the main language, the used language has to be described under @xml:lang of the concerned element.

3.2 Default values

No railML2.4nor extension attributes have default values. However, core railML2.4 defines default values, for some attributes that are used in railML2.4nor. The following shows the complete list of railML2.4 TT core attributes that have default values and exist in railML2.4nor:

<element>@attribute	Default Value	Condition, if existent
<times><mean><median>@arrivalDay	"0"	
<times><mean><median>@departureDay	"0"	
<ocpTT>@alignment	"center"	
<ocpTT>@offset	"0"	
<stopDescription>@guaranteedPass	"false"	<ocpTT>@ocpType = "pass"
<stopDescription>@commercial	"true"	<ocpTT>@ocpType = "stop"
<stopDescription>@onOff	"both"	<ocpTT>@ocpType = "stop" and <stopDescription>@commercial = "true"
<stopDescription>@stopOnRequest	"false"	<ocpTT>@ocpType = "stop" and <stopDescription>@commercial = "true"
<stopDescription>@operationalStopOrdered	"false"	<ocpTT>@ocpType = "stop" and <stopDescription>@commercial = "false"

Default values for all further railML2.4nor TT attributes can be defined by user systems. In case a value is not known for a mandatory attribute, the writing system will have to insert a value.
If attributes and their values are not written, this denotes that a value, or information to derive it, is unknown in the system producing the railML2.4nor file. This is regardless of whether it is not required there, or the value is missing and can be ignored by the receiving system.

3.3 Conventions

3.3.1 New elements and attributes

In this document, extension elements and attributes will be marked with a "nor:" prefix:

[nor:]+[attribute/element name]

Example: Extension element <nor:patternTrain>

Please note: If the value is part of a Norwegian extension element or attribute and the "nor" is already existent in either element or attribute, the "nor" is omitted.

Example: <nor:patternTrain>@interval

3.3.2 Extendibility of railML2.4nor enumerations

To be able to give information of not mappable values in the system producing a railML2.4nor file, a fixed value set (enumeration) of an attribute can be expanded by additional general values. These values have the following semantics in railML2.4nor:

- "other:*": Denotes a value (*) that is not part of or mappable to a value in the fixed railML2.4nor value set. This value can be ignored, mapped or handled by a local "other"-value in the receiving system.
- @code for element <category>
- @code for subelements of <organizationalUnits>

If no values are available for an attribute, optional attributes shall not be written. The procedure for mandatory attributes is explained in chapter 3.4.

3.4 Mandatory elements

Generally, railML2.4 TT and railML2.4nor TT define some elements and attributes as mandatory and others as optional. As railML2.4nor TT is an extension of railML2.4 TT, elements which are defined as mandatory in railML2.4 TT can never be optional in railML2.4nor TT. However, optional core railML2.4 TT elements can be made mandatory in railML2.4nor TT.

Further restrictions that cannot be recorded in the XSD exist in railML2.4nor TT. These are noted in the Excel sheet "railML2.4nor Timetable Model". In order to comply with the standard, these restrictions have to be taken into account.

3.5 Container elements

railML2.4nor TT contains various container elements. Most are part of core railML2.4 TT, e.g. <trainGroups>. Others were introduced as extension elements in railML2.4nor TT, e.g. <nor:patternTrains>. Please note that there must never be empty container elements in a railML2.4nor file. In other words: All container elements must have individual elements. This is reflected in the Excel sheet. For instance: the <trainGroups> container is optional, but if it exists, it must have at least one <trainGroup> element. Therefore, the <trainGroup> element is marked as mandatory. If no train groups are defined, the <trainGroups> container is skipped.

```
<trainGroups>
   <trainGroup […]>
         <trainRef […]/>
   </trainGroup>
</trainGroups>
```

3.6 Common attributes

In core railML2.4 TT and in railML2.4nor TT most elements have a set of attributes, which apply to a common set of semantics and value definitions. Nevertheless, some elements are exceptions to this rule. A complete overview over the elements that have or do not have those common attributes is given in the Excel sheet.

The following table lists the common set of attributes:

Attribute	Definition extension to Norwegian requirements, if applicable
@id	A unique ID string within the file's scope.
@name	(Human-readable) short string instance name.
@description	Human-readable description giving added information to the name.
@code	This is a UID for elements/objects.

3.7 Coherence to other subschemas

Files of the TT-scheme contain references to elements of the IS- and RS-scheme. These elements must be univocally defined for an unbroken reference and clear definitions. The current solution is to have all subschemas in one file. This way, the reference to the corresponding infrastructure file and the RS-file have to be stable. The immediate challenge with this solution is the size of the files that are being exchanged. To minimize the amount of IS and RS data that must be containted in a predominant TT schema railML file, the use of @code has to be stable to reference/map the details (for instance the properties of a vehicle). See the IS and RS documentation for rules for stable code values or reference to code lists.

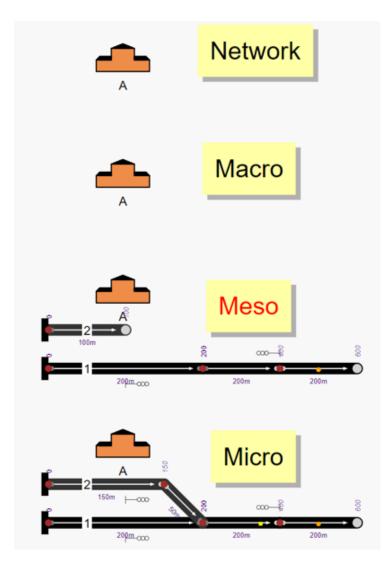Formations are referenced from a <trainPart> using <formationTT>@ref.

3.8 Model aggregation level

A "timetable file" will always contain both the timetable and the infrastructure schema of railML. The timetable model can be of different aggregation levels (in relation to level of details) just as the infrastructure model (see infrastructure documentation chapter 3.10; in version 1.4). The two model's aggregation level must correspond to each other. Infrastructure elements referenced to in the timetable scheme must be present in the railML file for valid XML.

railML2.4nor provides four modelling levels (see Figur 3 below) where timetable data present and infrastructure data present must correspond:

Detail of modelling	Description of element use in TT scheme of file	Mandatory IS scheme elements in file
Network	Sequence of OCPs. <ocpTT>@ocpRef	Macroscopic model with <ocp>
Macroscopic	Sequence of OCPs (<ocpTT>@ocpRef) with track number (<ocpTT>@trackInfo) corresponding to <track>@code or <track>@name	Macroscopic model with <ocp>
Mesoscopic	Sequence of OCPs (<ocpTT>@ocpRef) with reference (<ocpTT>@trackRef) to relevant <track>@id containing the track number in <track>@code and/or <track>@name	Macroscopic model with <ocp>, <track>@code and/or <track>@name

Detail of modelling	Description of element use in TT scheme of file	Mandatory IS scheme elements in file
Mesoscopic with stop position	As mesoscopic pluss: <stopDescription>@stopPostRef	Macroscopic model with <ocp>, <track>@code and/or <track>@name, <stopPost>s Use @virtual if no physical stopPost is present but TT requires a stop posistion.
Microscopic	As mesocopic with stop position pluss path description for the train: <sectionTT><trackRef>@ref	Microscopic model with <ocp>, <track>@code and/or <track>@name, <stopPost>s

Figur 3: Illustration of aggregation levels

3.9 Attendance of stations

To define an ocp attendance requirement of a train use <uptime> (under <ocp> in the Infrastructure scheme). The referenced <operatingPeriod> from <uptime> must match with the attendance requirement of the train in ocpTT for the same ocp.

3.10 Splitting of a <trainPart>

If different values for the same attribute to different parts of a <trainPart> apply, the <trainPart> should be split into several <trainPart>s where the desired values for the attribute can be set to each <trainPart>. A use case example for this procedure is the cancellation of a sequence of <ocpTT>s in a train run.

4 Element Specific Definitions and Extensions

4.1 Element <category>
Location in the scheme: <timetable>

4.1.1 Definition extension in accordance with Norwegian usage
We add a fixed list of top-level defined categories in the Norwegian sector and extensions to further define your own categories in a clear relation to the fixed ones.

Use of @categoryRef

railML provides two types of category references for trains: references to operational or to product categories. The use of the two is described in the [railML wiki](#).

- <trainPartSequence>@categoryRef: reference to an operational train category
- <trainPart>@categoryRef: reference to a product category

The Norwegian sector has defined common operational and product categories to be used as top-level categories, which will be listed in the following sections. Section 4.1.4 explains how to add organization-specific or custom categories in addition to the common ones.

4.1.2 Top-level operational categories
The following table lists the top-level **operational** categories for railML2.4nor. They are defined as "togslag" in the Norwegian sector. As described in section 4.2.6, these categories are referenced from <train><trainPartSequence>@categoryRef.

@code	@name	<additionalName> @name (use with xml:lang="en")	@trainUsage	@nor:trainUsage	@deadrun
At	Arbeidstog	Work	(from railML2.5) other: maintenance	maintenance	
Pt	Persontog	Passenger	passenger	passenger	
Gt	Godstog	Freight	goods	goods	
Bu	Buss	Bus	passenger	passenger	
Ht	Hjelpetog	Breakdown	passenger	passenger	
K	Kipptog	Shuttle freight	goods	goods	
KFT	Kongelig familie tog	Royal	passenger	passenger	
Ll	Løslok	Light engine	(from railML2.5) other:locomotive	locomotive	true
Sk	Skift	Shunting	passenger/goods	passenger/goods	true
T	Tomtog	Empty	passenger	passenger	true
EGt	Ekstra godstog	Extra freight	goods	goods	

EK	Ekstra kipptog		goods	goods	
EL	Ekstra løslok		(from railML2.5) other:locomotive	locomotive	true
EPt	Ekstra persontog	Extra passenger	passenger	passenger	
ET	Ekstra tomtog	Extra empty	passenger	passenger	true

4.1.3 Top-level product categories

The following table lists the top-level **product** categories for railML2.4nor. They are defined as "togkategorier" by Jernbanedirektoratet in the Norwegian sector. These are the strategic product categories. As described in section 4.2.6, the product categories are referenced from <trainPart>@categoryRef.

@code	@name	<additionalName> @name (use with xml:lang="en")	@trainUsage
C	Chartertog	Charter	passenger
F	Tilbringertjeneste til flyplass	Airport Flytoget (without xml:lang)	passenger
FJ	Fjerntog	Long-distance	passenger
FJE	Fjernekspresstog	Long-distance express	passenger
FJN	Nattog	Night	passenger
GF	Fleksitog	Mixed freight	goods
GK	Kombitog	Combined freight	goods
GS	Systemtog	System freight	goods
GV	Vognlasttog	Wagonload freight	goods
Lt	Lokaltog	Local	passenger
R	Regiontog	Regional	passenger
RD	Regiontog i distriktene	Rural regional	passenger
RE	Regionekspresstog	Regional express Intercity (without xml:lang)	passenger
St	Storbytog	Suburban	passenger

4.1.4 Adding organization-specific or custom categories

If there is a need to define more detailed categories in addition to the common top-level categories listed above, they can be created by adding new ones. Any new category must be linked to an existing parent category, which can be either a top-level category or another organization-specific one. By following the values of the attribute @nor:parentRef, one must always be able to trace a new category to one of the top-level categories. All new categories must declare the organisational unit that created it.

Charge categories

For charge categories for billing purposes of the access charge (named "produktkode for

markedssegmentering» by Bane NOR), make new operational category instances with
@nor:parentRef to the relevant operational category listed here (see section 4.2.10).

Marketing categories

For commercial categories to the public for marketing purpose (named "togtype" by Bane NOR),
make new product category instances with @nor:parentRef to the relevant product category listed
here (see section 4.2.10).

4.1.5 Attribute extension

The element <category> is extended by the following attributes in railML2.4nor:

Attribute of <category>	Description	Type
@nor:organizationalUnitRef	Refer to the organisation that has created the category. (See section 4.1.4). Mandatory for new items.	rail:tGenericRef
@nor:parentRef	Reference to the parent category if declaring a new category to the top-level list above. Mandatory for new items.	rail:tGenericRef
@nor:trainUsage	Defines the trains transportation purpose (passenger, goods, maintenance, or locomotive). Use together with @trainUsage and its corresponding value when possible.	xs:enumeration

4.1.6 Code example

```
<categories>
  <category id="c1" code="Pt" name="Persontog"
            trainUsage="passenger"/>
  <category id="c2" code="T1" name="Trafikkpk.1/SB"
            trainUsage="passenger"
            nor:organizationalUnitRef="[@id for "Bane NOR"]"
            nor:parentRef="c1"/>
  <category id="c3" code="FJ" name="Fjerntog"
            trainUsage="passenger"/>
  <category id="c4" code="Sø" name="Sørtoget"
            trainUsage="passenger"
            nor:organizationalUnitRef="[@id for "GO Ahead"]"
            nor:parentRef="c3"/>
</categories>
...
<trainpart id="tp1" categoryRef="c4">
...
<train>
 <trainpartSequence categoryRef="c2">
  <trainPartRef ref="tp1"/>
```

4.2 Element <connection>
Location in the scheme: <timetable><trainParts><trainPart><ocpsTT><ocpTT><connections>

4.2.1 Definition extension in accordance with Norwegian usage
In the Norwegian railway sector, the element <connection> is used to describe both passenger-oriented connections as well as operational connections. As for operational connections the element is used to model crossing and overtaking manoeuvres.

The <connection> element will indicate whether there is an operational or commercial connection between two trains and specifies their sequence. To state the kind of connection, see section 4.9.2.

Attribute of <connection>	Definition in accordance with Norwegian usage
@connType	This attribute defines if the connection is of commercial or operational nature. Commercial connections are communicated to the passengers, whereas operational connections are not.

Reference to the "other" train

There are two different ways to refer to the train the connection is taking place with. The usage of the reference is dependent on whether this other train is included in the current timetable:

- If the other train is included in the same file: the attribute @trainRef or @trainPartRef in <connection> can be used. It is recommended to use either only @trainPartRef or @trainPartRef in addition to @trainRef.
- If the other train is not included in the same file: use an external reference-element: <connection><externalReference><trainNumber>@trainNumber.

4.2.2 Code example

```xml
<trainPart id="tp1">
   <ocpsTT>
     <ocpTT sequence="3" ocpRef="id1" ocpType="stop">
       <connections>
           <connection trainPartRef="tp2" connType="operational"/>
       </connections>
       <!--  see section 0 for usage of <stopDescription>
           and <stopActivity> -->
     </ocpTT>
   </ocpsTT>
</trainPart>

<trainPart id="tp2">
   <ocpsTT>
     <ocpTT sequence="12" ocpRef="id1" ocpType="pass"/>
       <connections>
           <connection trainPartRef="tp1" connType="operational"/>
       </connections>
       <!--  see section 0 for usage of <stopDescription>
           and <stopActivity> -->
     </ocpTT>
   </ocpsTT>
</trainPart>
```

4.3 Element <nor:distribution>

Location in the scheme: <timetable><nor:distributions>

Please note: The modelling of pattern trains is currently under review and there will be changes in the next version.

Flexible description of the detailed distribution of number of trains.

4.3.1 Definition
Describes the distribution of trains over time, using a series of slots.

4.3.2 Subelement <nor:slot>

Attribute of <nor:slot>	Description	Type
@numberOfTrains	The number of trains in this time slot	xs:integer
@startTime	Beginning of the slot	xs:time
@duration	Duration of the slot	xs:duration
@operatingPeriodRef	Reference to an <operatingPeriod> describing the precise days that the distribution applies to.	rail:tGenericRef

4.3.3 Subelement <nor:operatingDay> of <nor:slot>
One or more <nor:operatingDay> elements can be used to describe which day(s) of the week the trains that use this distribution will be run. It mirrors the definition of <operatingDay> in railML 2.4 and is used just like <operatingDay> is used for <operatingPeriod>s.

4.3.4 Code example

```xml
<nor:distributions>
  <nor:distribution id="dist1">
    <nor:slot numberOfTrains="38" startTime="00:00:00" duration="P1D"/>
  </nor:distribution>
  <nor:distribution id="dist2">
    <nor:slot numberOfTrains="1" startTime="04:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="05:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="4" startTime="06:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="07:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="08:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="09:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="10:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="11:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="12:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="13:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="14:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="15:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="4" startTime="16:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="17:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="18:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="2" startTime="19:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="1" startTime="20:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="1" startTime="21:00:00" duration="PT1H"/>
    <nor:slot numberOfTrains="1" startTime="22:00:00" duration="PT1H"/>
  </nor:distribution>
</nor:distributions>
```

4.4 Element <nor:patternTrain>

Location in the scheme: <timetable><nor:patternTrains>

Please note: The modelling of pattern trains is currently under review and there will be changes in the next version.

A pattern train is a template for other trains. It is not itself a train that is supposed to run. The purpose of pattern trains in this specification is as a part of the description of a <trainGroup>.

4.4.1 Definition

The <nor:patternTrain> element reuses the subelement <trainPartSequence> of the <train> element in railML 2.4.

4.4.2 Attributes

Same attributes as <train> with the following extensions:

Attribute of <nor:patternTrain>	Description	Type
@interval	Interval in seconds between trains formed by this pattern train. In case of uneven but repeated intervals, use a space-separated list of intervals, e.g. "600 1200 1800".	xs:list of xs:positiveInteger
@trainsPerHour	Number of trains per normal traffic hour. If there is less than one train per hour, use @trainsPerDay. For more details, use nor:distributions.	xs:positiveInteger
@trainsPerDay	Number of trains per normal traffic day (for more details use nor:distributions)	xs:positiveInteger
@trainsPerWeek	Number of trains per normal traffic week (for more details use nor:distributions)	xs:positiveInteger
@distributionRef	Reference to a <nor:distribution>, which describes how the trains are spread out over time.	rail:tGenericRef

4.4.3 Code example

```
<nor:patternTrains>
  <nor:patternTrain type="operational" id="pat-1" name="R10"
      interval="1200 2400" trainsPerHour="2" trainsPerDay="38"
      distributionRef="dist2">
    <trainPartSequence sequence="1">
      <trainPartRef ref="tp-d1"/>
    </trainPartSequence>
  </nor:patternTrain>
</nor:patternTrains>
```

4.5 Element <ocpTT>

Location in the scheme: <timetable><trainParts><trainPart><ocpsTT>

4.5.1 Attributes

Attribute of <ocpTT>	Definition in accordance with Norwegian usage
@trackInfo	This attribute is the public name of a station track in the format that is communicated to the passengers.
@trackRef	A reference to the track element in the infrastructure scheme.

4.5.2 Code example

```
<ocpsTT>
  <ocpTT sequence="23" ocpRef="id51" ocpType="stop" trackInfo="3"
    trackRef="tr1150" nor:trackDescription="SP3-L"/>
</ocpsTT>
```

4.6 Element <organizationalUnits>

Location in the scheme: <railML><metadata><organizationalUnits>

4.6.1 Definition extension in accordance with Norwegian usage

The element <organizationalUnits> is located in the Common scheme. It is described in the TT-documentation because of references to the organizational units. The element <organizationalUnits> is a container element for pre-defining organizational units that will be referred from within the railML file according to the railML-wiki. Organizational units are railway related organisations that can be a government authority, local authority, corporation, enterprise, public company, private company, undertaking/body or other legal entity.

Each element may be used several times for several entries, as e.g. a network may be divided into areas with different infrastructure managers, and as within the network there will usually move vehicles from different producers.

Note that the type of the organizational Unit is declared by the subelement that is used. If the same organisation is relevant for several roles it has to be defined as several elements.

The Norwegian national safety authority Statens Jernbanetilsyn (SJT) lists all approved railway organisations of subelements <infrastructureManager>, <railwayUndertaking> and <contractor> in Norway on their website. This list is strongly suggested to be used for the official values of the attribute @name of each element created. Note that only <infrastructureManager> has a stable code list made by railML.org. For code list values see chapter 7.1.

In the following the subelements of <organizationalUnits> that are defined more precisely in railML2.4nor TT for the usage in the Norwegian railway sector are listed in alphabetical order. Additionally, a new subelement <nor:vehicleOwner> is introduced in section 4.6.6.

4.6.2 Element <concessionaire>

A <railwayUndertaking> that has received and operates under a concession from a <customer>.

This value is not used in railML2.4nor. Use element <railwayUndertaking> instead.

4.6.3 Element <contractor>

Any relevant organisation not fitting into the other subelements of <organizationalUnits> is defined here.

4.6.4 Element <customer>

An organisation that orders transportation service from a railway undertaking. The customer can have exclusive transportation ownership rights (concessions) or operate on open access.

Example: The predominant customer for passenger transport in Norway is Jernbanedirektoratet: <customer>@name="Jernbanedirektoratet" with @code="JDIR".

4.6.5 Element <infrastructureManager>

An organisation that is responsible for establishing and maintaining railway infrastructure, which may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings.

Via code it can be linked to the codelist infrastructureManagers.xml, where numerous infrastructure managers are listed.

The Norwegian national railway network is exclusive managed by Bane NOR: <infrastructureManager>@name="Bane NOR" with @code="BN".

4.6.6 Element <nor:vehicleOwner>

Implementation note: To allow a new subelement <nor:vehicleOwner> in <organizationalUnits>, the element <organizationalUnits> is defined with xsi:type="nor:organizationalUnits" as shown in the example in section 4.6.11.

4.6.6.1 Definition

A vehicle owner is an organisation that has the purpose of making railway vehicles available for railway undertakings.

4.6.6.2 Attributes

The element includes the common attributes that are described in section 3.6.

4.6.6.3 Subelements

Like all other subelements of <organizationalUnits> have a subelement <additionalName>, this applies to the newly introduced <nor:vehicleOwner> as well.

4.6.7 Element <operationalUndertaking >

An organisation responsible for the operational performance of a railway undertakings service (usually as a sub-contractor). Examples are organisations responsible for catering, cleaning or vehicle maintenance.

4.6.8 Element <vehicleManufacturer>

An organisation that produces railway vehicles. Example: <vehicleManufacturer>@name="Stadler Rail AG".

4.6.9 Element <vehicleOperator>

An organisation responsible for operating the railway vehicle on behalf of a railway undertaking (usually as a sub-contractor).
This is seldom used in Norway.

4.6.10 Element <railwayUndertaking>

An organisation licensed according to applicable legislation, which principal business is to provide services for the transport of goods and/or passengers by rail with a requirement that the undertaking must ensure traction and is commercially responsible for the service. All approved railway undertakings in Norway are listed on the webpage of SJT, see section 4.6.1.

Use in <organizationalUnitBinding> under <trainPart>

Only use <vehicleOperator> or <operationalUndertaking> if different from <railwayUndertaking>.

4.6.11 Code example

```xml
<metadata>
  <organizationalUnits xsi:type="nor:organizationalUnits">
   <infrastructureManager id="im-1" code="BN" name="Bane NOR SF"/>
   <customer id="cu-1" code="DIR" name="Jernbanedirektoratet"/>
   <railwayUndertaking id="ru-1" code="VY" name="Vygruppen AS"/>
   <railwayUndertaking id="ru-2" code="GAG" name="Go-Ahead Norge AS"/>
   <railwayUndertaking id="ru-3" code="CN" name="CargoNet AS"/>
   <operationalUndertaking id="ou-1" name="Oslo Havn KF"/>
   <nor:vehicleOwner id="vo-1" code="NOR" name="Norske Tog"/>
  </organizationalUnits>
</metadata>
```
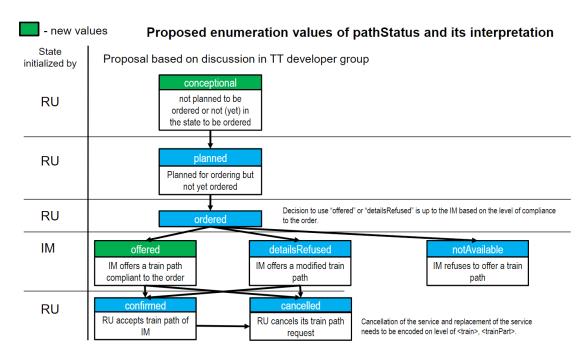
4.7 Attribute @pathStatus

Location in the scheme: <timetable><trains><train><trainPartSequence>

The attribute @pathStatus is used to describe the different stages in a slot allocation process. These stages are illustrated in Figur 4.

If the general planning stage (e.g. "long term plan") of the model is global for the railML file/transmission, this should be submitted in the <metadata> element. These stages are not standardised, but should reflect the general phases: strategic, tactical/long term, operational/short term, historic, together with a more detailed description.

Figur 4: Process flow for @pathStatus (source: iRFP)

Do not use @processStatus (on <trainPart>, <train> and <trainGroup>), as this attribute is **deprecated** and will be replaced with a more covering element <state> in railML2.5.

Use @pathStatus to indicate the current status of the slot allocation process stage. The stages are illustrated above and defined in the railML wiki.

4.7.1 Enumeration extension

In anticipation of railML2.5 and with the correct use of "other:*" and extended to the Norwegian use case the following values are amended:

- @pathStatus="other:conceptual" to describe a trainPath that is not planned to be ordered or not (yet) in the state to be ordered.
- @pathStatus="other:offered" to describe a trainPath that has been offered by the IM in response to an ordered trainPath submitted by the RU.

4.8 Element <sectionTT>
Location in the scheme: <timetable><trainParts><trainPart><ocpsTT><ocpTT>

4.8.1 Definition extension in accordance with Norwegian usage
The element is used for an unambiguous definition of the path of a <sectionTT> with precise start and end points. Based on which aggregation level the TT/IS model is using (se Figur 3), the modelling is the following:

Network aggregation level:

In the seldom case that there exist two lines between two OCP's with no intermediate OCP in between, use <sectionTT>@lineRef or describe the path for human interpretation in <sectionTT>@section and do not use <trackRef>.

Macroscopic aggregation level:

For a macroscopic model with only a main track with or without station tracks where there is no alternate path to choose from, do not use <sectionTT> as it does not give any added value. If there is an alternate path use <sectionTT>@lineRef

Microscopic aggregation level:

For a microscopic model use <trackRef> for all tracks forming the path from the start position of the current <ocpTT>. The start position and end position of the path that forms the tracks to be referenced, changes depending if there is have defined a stop position or not.

- **Without stop positions**
  Here the tracks containing the <crossSection> elements form the start (from and including) and end (to and including) tracks to be referenced.
- **With stop positions**
  Here the tracks containing the referenced infrastructure object referenced from <stopDescription> forms the start (from and including) and end (to and including) tracks to be referenced.

4.8.2 Code example
In the illustrated example bellow the tracks to be referenced are:

Figure 1: Microscopic track model of 3 stations

Example code without a stop position:

```
<ocpsTT>
  <ocpTT sequence="1" ocpRef="A">
    <sectionTT>
      <trackRef ref="tr1">
      <trackRef ref="tr3">
      <trackRef ref="tr6">
      <trackRef ref="tr8">
    </sectionTT>
  </ocpTT>
  <ocpTT sequence="2" ocpRef="B">
    <sectionTT>
      <trackRef ref="tr8">
      <trackRef ref="tr10">
      <trackRef ref="tr9">
      <trackRef ref="tr12">
      <trackRef ref="tr14">
    </sectionTT>
  </ocpTT>
</ocpsTT>
```

Example code with a stop position:

```
<ocpsTT>
  <ocpTT sequence="1" ocpRef="A">
    <sectionTT>
      <trackRef ref="tr3">
      <trackRef ref="tr6">
      <trackRef ref="tr8">
      <trackRef ref="tr10">
      <trackRef ref="tr9">
    </sectionTT>
  </ocpTT>
  <ocpTT sequence="2" ocpRef="B">
    <sectionTT>
      <trackRef ref="tr9">
      <trackRef ref="tr12">
      <trackRef ref="tr14">
      <trackRef ref="tr16">
    </sectionTT>
  </ocpTT>
</ocpsTT>
```

4.9 Element <stopDescription>

Location in the scheme: <timetable><trainParts><trainPart><ocpsTT><ocpTT>

The element <stopDescription> describes information about a stop at the concerned ocp according to the [railML wiki](#). The attribute @stopPostRef gives a reference to the associated physical or virtual <stopPost> element.

4.9.1 Subelement <trackInfo>

Location in the scheme: <timetable><trainParts><trainPart><ocpsTT><ocpTT><stopDescription>

To define any alternative tracks for a train within a station for timetable planning and simulation, the element <trackInfo> is extended by two attributes in railML2.4nor as given in the following table.

Attribute of <trackInfo>	Description	Type
@nor:trackRef	A reference to the track element in the infrastructure scheme.	rail:tGenericRef
@nor:rank	Indication of the rank, if more than one <trackInfo> exist. The attribute has a semantic constraint of the value 2 or higher, as the primary track is given as an attribute in the element <ocpTT>.	xs:positiveInteger

4.9.2 Subelement <stopActivity>

4.9.2.1 Attributes in accordance with Norwegian usage

The following list shows values of the attribute @type of <stopActivity> that are used in the Norwegian railway sector. It includes both core railML values that have an extended definition in railML2.4nor TT and newly introduced values. A complete list of all values used for @type can be found in the railML2.4nor TT excel-sheet.

Value of attribute @type	Description
crewChange	Describes both the change of the driver and the change of on-board personell.
supplyOrDisposal	Includes the refuelling of the vehicle with diesel fuel.
other:noCollectOrDrop	No attach and no standstill of waggons
Attributes for description of the type of an operational <connection> between two trains:	
occupationCrossing	Describes the stop or the pass of a train at the concerned ocp because of a planned crossing. If the train is stopping or passing is given via ocpTT@ocpType.
other:occupationCrossingConflict	Describes the stop or the pass of a train at the concerned ocp because of a planned crossing. If the train is stopping or passing is given via ocpTT@ocpType. The crossing procedure is displayed as a conflict in the timetable.
occupationBlock	Describes the stop or the pass of a train at the concerned ocp because of a planned overtaking. If the train is stopping or passing is given via ocpTT@ocpType.
other:occupationBlockConflict	Describes the stop or the pass of a train at the concerned ocp because of a planned overtaking. If the train is stopping or passing is given via

	ocpTT@ocpType. The overtaking procedure is displayed as a conflict in the timetable.

4.9.2.2 Code example

```
<stopActivity type="supplyOrDisposal"/>
<stopActivity type="crewBreak"/>
```

4.10 Element <trainGroup>

Location in the scheme: <timetable><trainGroups>

This is a core railML element, extended with new attributes. The use case for the extension is to group trains that belong to the same service and to describe properties of that service as part of a service concept, or to give additional information during timetable planning.

A service is defined as a group of trains that run under a common name with the same stopping pattern and which usually have the same travel time between the common start and end stations. For example: "RE10" running between Skien and Lillehammer via Oslo.

The service name should also be set with <trainPart>@line, documented in the wiki as "This is the code or number of the train service that this train part belongs to".

The commercial and operational category of a <trainGroup> is determined by checking the commercial and operational category of the <nor:patternTrain> referenced by @nor:patternTrainRef, or the categories of the <train>s referenced by <trainRef>s when there is no pattern train.

4.10.1 Attributes

The element <trainGroup> uses the following attributes in railML2.4nor:

Attribute of <trainGroup>	Description	Type
@name	Service name. Usually consists of the commercial <category>@code and the line number. Example: "RE10"	xs:string (mandatory)
@type	Use "interval" for regular-interval services. Use "other:service" for services without regular intervals.	xs:enumeration
@nor:trainNumbersFrom	Start of the range of train numbers for the service, e.g. 300.	xs:integer (optional)
@nor:trainNumbersTo	End of the range of train numbers for the service, e.g. 354.	xs:integer (optional)
@nor:parentRef	Reference to a parent <trainGroup>, which is a group of groups. *Example: trains that belong to the same service can be grouped into one group for the fixed-interval trains and another group for additional rush hour trains. Each of the two groups can reference a parent group for the whole service.*	rail:tGenericRef (optional)
@nor:patternTrainRef	Reference to a <nor:patternTrain> functioning as a template for trains in this <trainGroup>.	rail:tGenericRef (optional)

4.10.2 Code example

```xml
<trainGroup id="tg-2" code="RE10" name="IC-tog Drammen-Lillehammer"
    type="other:service" nor:trainNumbersFrom="300"
    nor:trainNumbersTo="354"/>
<trainGroup id="tg-3" code="RE10" name="IC-tog Drammen-Lillehammer
    grunnrute" type="interval" nor:trainNumbersFrom="300"
    nor:trainNumbersTo="349" nor:patternTrainRef="pat-1"
    nor:parentRef="tg-2">
  <trainRef sequence="1" ref="tr-18"/>
  <trainRef sequence="2" ref="tr-19"/>
  <trainRef sequence="3" ref="tr-20"/>
  <trainRef sequence="4" ref="tr-21"/>
  <!-- ... -->
</trainGroup>
<trainGroup id="tg-4" code="RE10" name="IC-tog Drammen-Lillehammer
    rush" type="interval" nor:trainNumbersFrom="350"
    nor:trainNumbersTo="354" nor:patternTrainRef="pat-2"
    nor:parentRef="tg-2">
  <trainRef sequence="1" ref="tr-45"/>
  <trainRef sequence="2" ref="tr-46"/>
  <trainRef sequence="3" ref="tr-47"/>
  <trainRef sequence="4" ref="tr-48"/>
</trainGroup>
```

4.11 Element <nor:alternativeSectionTT>

Location in the scheme: <timetable><trainParts><trainPart><ocpsTT><ocpTT>

Implementation note: This element is needed because <sectionTT> is not allowed to occur more than once. If @rank is added and the multiplicity of <sectionTT> is changed in later railML versions, this extension element becomes redundant.

4.11.1 Definition

The primary path of a train(part) is indicated with <sectionTT>. To indicate the alternative paths to be available for a train(part) if the primary (planned) path is not available. This being in a simulation, short term scheduling, dispatching decisions or data preparation for long term planning.

For this purpose, use the extension <nor:alternativeSectionTT>. The description of alternative paths is purely informational. Therefore, the element uses the same attributes and subelements of <sectionTT> except for <runTimes>.

4.11.2 Attribute extension

The element is extended by an attribute @rank to indicate the rank between the different elements, if more than one <nor:alternativeSectionTT> exist. The attribute has a semantic constraint of the value 2 or higher, as the primary path for a train(part) is given in the element <sectionTT>.

4.11.3 Code example

According to Figure 1 the primary path from A-B is via track "tr8" and the secondary path via track "tr7".

```xml
<ocpsTT>
  <ocpTT sequence="1" ocpRef="A">
    <sectionTT>
      <trackRef ref="tr3">
      <trackRef ref="tr6">
      <trackRef ref="tr8">
      <trackRef ref="tr10">
      <trackRef ref="tr9">
    </sectionTT>
    <nor:alternativeSectionTT rank="2">
      <trackRef ref="tr3">
      <trackRef ref="tr6">
      <trackRef ref="tr7">
      <trackRef ref="tr9">
    </nor:alternativeSectionTT>
  </ocpTT>
</ocpsTT>
```

5 railML2.4nor TT example

Included in this documentation is a simple example of the railML2.4nor TT schema.

Figure 2- Illustration of the macroscopic infrastrucure included in the TT example

```xml
<?xml version="1.0" encoding="UTF-8"?>
<railml xmlns="https://www.railml.org/schemas/2018"
        xmlns:nor="http://www.jernbanedirektoratet.no/railml"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="https://www.railml.org/schemas/2018 https://www.railml.org/schemas/2018/railML-2.4/schema/railML.xsd
                            http://www.jernbanedirektoratet.no/railml https://www.jernbanedirektoratet.no/globalassets/dokumenter/railml/norextension.xsd"
        version="2.4">

  <metadata xmlns:dc="http://purl.org/dc/elements/1.1/">
    <dc:date>2020-01-23T16:03:00Z</dc:date>
    <dc:source>written by hand in Notepad++ and Altova XMLSpy</dc:source>
    <dc:description>TT Strategic example rev3, last changed 2020-12-17 by Thomas Nygreen</dc:description>
    <dc:language>no-NO</dc:language>
    <dc:source>https://railoscope.com/workspace/5c18e681aa6a000810cca6c0?modelId=5cdbbd73babe8a08767aae28&amp;revision=74</dc:source>
    <dc:creator>Torben Brand</dc:creator>
    <dc:creator>Thomas Nygreen</dc:creator>
    <organizationalUnits xsi:type="nor:organizationalUnits">
      <infrastructureManager id="im-1" code="BN" name="Bane NOR SF"/>
      <customer id="cu-1" code="DIR" name="Jernbanedirektoratet"/>
      <railwayUndertaking id="ru-1" code="VY" name="Vygruppen AS"/>
      <railwayUndertaking id="ru-4" code="VYT" name="Vy Tog AS"/>
      <railwayUndertaking id="ru-2" code="GAG" name="Go-Ahead Norge AS"/>
      <railwayUndertaking id="ru-3" code="CN" name="CargoNet AS"/>
      <operationalUndertaking id="ou-1" name="Oslo Havn KF"/>
      <nor:vehicleOwner id="vu-1" code="NOR" name="Norske Tog AS"/>
    </organizationalUnits>
  </metadata>

  <infrastructure id="infra-1421" name="BB small selection">
    <tracks>

      <!-- Tracks in GUV -->
      <track id="tr1" name="">
        <trackTopology>
```

```xml
        <trackBegin id="tb1" pos="0">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackBegin>
        <trackEnd id="te1" pos="200">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackEnd>
      </trackTopology>
    </track>
    <track id="tr2">
      <trackTopology>
        <trackBegin id="tb2" pos="0">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackBegin>
        <trackEnd id="te2" pos="200">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackEnd>
      </trackTopology>
    </track>
    <track id="tr3" name="1">
      <trackTopology>
        <trackBegin id="tb3" pos="0">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackBegin>
        <trackEnd id="te3" pos="200">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackEnd>
        <crossSections>
          <crossSection id="cs3" pos="80" ocpRef="ocp-1"/>
        </crossSections>
      </trackTopology>
      <ocsElements>
        <signals>
          <signal id="sig1" pos="170" name="A"/>
        </signals>
        <stopPosts>
          <stopPost id="stv1" pos="170" trainLength="120" virtual="true"/>
        </stopPosts>
      </ocsElements>
    </track>
    <track id="tr4">
      <trackTopology>
        <trackBegin id="tb4" pos="0">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackBegin>
        <trackEnd id="te4" pos="200">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackEnd>
      </trackTopology>
    </track>

    <!-- Track from GUV to FLÅ -->
    <track id="tr5">
      <trackTopology>
        <trackBegin id="tb5" pos="0">
          <macroscopicNode ocpRef="ocp-1"/>
        </trackBegin>
        <trackEnd id="te5" pos="6000">
          <macroscopicNode ocpRef="ocp-2"/>
        </trackEnd>
```
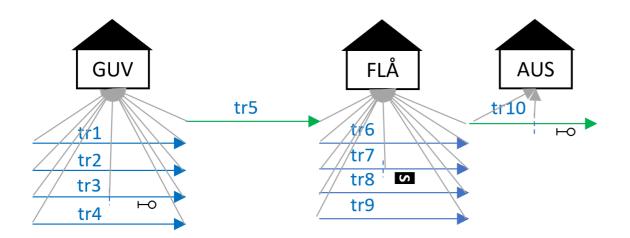
```xml
          </trackTopology>
        </track>

        <!-- Tracks in FLÅ -->
        <track id="tr6">
          <trackTopology>
            <trackBegin id="tb6" pos="0">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackBegin>
            <trackEnd id="te6" pos="200">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackEnd>
          </trackTopology>
        </track>
        <track id="tr7">
          <trackTopology>
            <trackBegin id="tb7" pos="0">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackBegin>
            <trackEnd id="te7" pos="200">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackEnd>
            <crossSections>
              <crossSection id="cs7" pos="80" ocpRef="ocp-2"/>
            </crossSections>
          </trackTopology>
          <ocsElements>
            <stopPosts>
              <stopPost id="st1" pos="160" trainLength="120"/>
            </stopPosts>
          </ocsElements>
        </track>
        <track id="tr8">
          <trackTopology>
            <trackBegin id="tb8" pos="0">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackBegin>
            <trackEnd id="te8" pos="200">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackEnd>
          </trackTopology>
        </track>
        <track id="tr9">
          <trackTopology>
            <trackBegin id="tb9" pos="0">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackBegin>
            <trackEnd id="te9" pos="200">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackEnd>
          </trackTopology>
        </track>

        <!-- Track from FLÅ to ... -->
        <track id="tr10">
          <trackTopology>
            <trackBegin id="tb10" pos="0">
              <macroscopicNode ocpRef="ocp-2"/>
            </trackBegin>
```

```xml
            <trackEnd id="te10" pos="200">
              <openEnd id="oe2"/>
            </trackEnd>
            <crossSections>
              <crossSection id="cs10" pos="80" ocpRef="ocp-3"/>
            </crossSections>
          </trackTopology>
          <ocsElements>
            <signals>
              <signal id="sig2" pos="170" name="A"/>
            </signals>
            <stopPosts>
              <stopPost id="stv2" pos="170" trainLength="120" virtual="true"/>
            </stopPosts>
          </ocsElements>
        </track>
      </tracks>

      <operationControlPoints>
        <ocp code="GUV" id="ocp-1" name="Gulsvik St">
          <nor:propOperationalAdditional remoteControlled="true" simultaneousEntry="trvAlt2"/>
          <propOperational operationalType="station"/>
          <propEquipment>
            <trackRef ref="tr1"/>
            <trackRef ref="tr2"/>
            <trackRef ref="tr3"/>
            <trackRef ref="tr4"/>
          </propEquipment>
          <tsi country="76"/>
          <geoCoord coord="60.383209 9.605504"/>
          <designator entry="GUV" register="SJN"/>
        </ocp>
        <ocp code="FLÅ" id="ocp-2" name="Flå St">
          <nor:propOperationalAdditional remoteControlled="true" simultaneousEntry="none"/>
          <propOperational operationalType="station" trafficType="passenger"/>
          <propService bus="true"/>
          <propEquipment>
            <trackRef ref="tr6"/>
            <trackRef ref="tr7"/>
            <trackRef ref="tr8"/>
            <trackRef ref="tr9"/>
          </propEquipment>
          <tsi country="76"/>
          <geoCoord coord="60.4321 9.4733"/>
          <designator entry="FLÅ" register="SJN"/>
        </ocp>
        <ocp code="AUS" id="ocp-3" name="Austvoll Bp">
          <nor:propOperationalAdditional remoteControlled="true"/>
          <propOperational operationalType="blockSignal"/>
          <tsi country="76"/>
          <designator entry="AUS" register="SJN"/>
        </ocp>
      </operationControlPoints>
    </infrastructure>

    <rollingstock id="rs-796796" name="Standard RS JDIR Rev02072020">
      <vehicles>
        <vehicle id="id-v1" code="type73-a" vehicleCategory="motorCoach"/>
        <vehicle id="id-v2" code="el18" vehicleCategory="motorVehicles"/>
```

```
      </vehicles>
    <formations>
      <formation name="operational long distance double EMU with tilt" id="fm-1" code="Type 73x2">
        <trainOrder>
          <vehicleRef orderNumber="1" vehicleRef="id-v1"/>
          <vehicleRef orderNumber="2" vehicleRef="id-v1"/>
        </trainOrder>
      </formation>
      <formation name="El18 loco with passenger wagons" id="fm-2" code="El 18+waggons">
        <trainOrder>
          <vehicleRef orderNumber="1" vehicleRef="id-v2"/>
        </trainOrder>
      </formation>
    </formations>
  </rollingstock>

  <timetable id="tt-796796b">
    <nor:distributions>
      <nor:distribution id="dist1">
        <nor:slot numberOfTrains="38" startTime="00:00:00" duration="P1D"/>
      </nor:distribution>
      <nor:distribution id="dist2">
        <nor:slot numberOfTrains="1" startTime="04:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="05:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="4" startTime="06:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="07:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="08:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="09:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="10:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="11:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="12:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="13:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="14:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="15:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="4" startTime="16:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="17:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="18:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="2" startTime="19:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="1" startTime="20:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="1" startTime="21:00:00" duration="PT1H"/>
        <nor:slot numberOfTrains="1" startTime="22:00:00" duration="PT1H"/>
      </nor:distribution>
    </nor:distributions>

    <nor:patternTrains>
      <nor:patternTrain type="operational" id="pat-1" name="R10" interval="1200 2400" trainsPerHour="2" trainsPerDay="38" distributionRef="dist1">
        <trainPartSequence sequence="1">
          <trainPartRef ref="tp-d1"/>
        </trainPartSequence>
      </nor:patternTrain>
    </nor:patternTrains>

    <timetablePeriods>
      <timetablePeriod id="ttp-796796" name="Taktisk" description="Taktisk 19.0" startDate="2018-12-09" endDate="2019-12-14"/>
    </timetablePeriods>

    <operatingPeriods>
      <operatingPeriod id="op-576532" startDate="2018-12-09" timetablePeriodRef="ttp-796796" endDate="2019-12-14" description="Alle dager"
bitMask="1111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111">
```

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11111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
1111111111111111111111111111111111111111111111111">
        <operatingDay operatingCode="1111111"/>
      </operatingPeriod>
    </operatingPeriods>

    <categories>
      <category id="cat-1" code="Pt" name="Persontog" trainUsage="passenger"/>
      <category id="cat-2" code="T1" name="Trafikpk.1/SB" trainUsage="passenger" nor:organizationalUnitRef="im-1" nor:parentRef="cat-1"/>
      <category id="cat-3" code="FJ" name="Fjerntog" trainUsage="passenger"/>
      <category id="cat-4" code="Søt" name="Sørtoget" nor:organizationalUnitRef="ru-2" nor:parentRef="cat-3"/>
    </categories>

    <trainParts>
      <trainPart id="tp-1" categoryRef="cat-4">
        <formationTT formationRef="fm-2" speed="160" weight="800" length="230"/>
        <operatingPeriodRef ref="op-576532"/>
        <ocpsTT>
          <ocpTT ocpRef="ocp-1" ocpType="stop" sequence="1" trackRef="tr3" trackInfo="1">
            <times scope="published" departure="15:03:00"/>
            <times scope="scheduled" departure="15:03:00"/>
            <sectionTT>
              <trackRef ref="tr3"/>
            </sectionTT>
            <stopDescription commercial="false" stopPostRef="stv1">
              <stopTimes operationalReserve="PT40S"/>
              <stopActivities>
                <stopActivity type="occupationCrossing"/>
              </stopActivities>
            </stopDescription>
            <nor:alternativeSectionTT rank="2">
              <trackRef ref="tr2"/>
            </nor:alternativeSectionTT>
          </ocpTT>
          <ocpTT ocpRef="ocp-2" ocpType="stop" sequence="2" trackRef="tr7" trackInfo="1">
            <times scope="published" arrival="15:06:00" departure="15:07:00"/>
            <times scope="scheduled" arrival="15:06:20" departure="15:06:50"/>
            <sectionTT>
              <trackRef ref="tr4"/>
              <trackRef ref="tr5"/>
              <trackRef ref="tr6"/>
              <trackRef ref="tr7"/>
            </sectionTT>
            <stopDescription commercial="true" stopPostRef="st1">
              <stopTimes minimalTime="PT30S"/>
            </stopDescription>
          </ocpTT>
          <ocpTT ocpRef="ocp-3" ocpType="pass" sequence="3" trackRef="tr10" trackInfo="H">
            <times scope="published" arrival="15:11:00" departure="15:11:00"/>
            <times scope="scheduled" arrival="15:11:00" departure="15:11:00"/>
            <sectionTT>
              <trackRef ref="tr9"/>
              <trackRef ref="tr10"/>
            </sectionTT>
            <stopDescription commercial="false" purpose="pass" stopPostRef="stv2"/>
          </ocpTT>
        </ocpsTT>
        <organizationalUnitBinding>
          <railwayUndertaking ref="ru-1"/>
```

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                <operationalUndertaking ref="ou-1"/>
            </organizationalUnitBinding>
        </trainPart>

        <trainPart id="tp-d1" name="R10" trainNumber="100-159" categoryRef="cat-4">
            <formationTT formationRef="fm-1"/>
            <ocpsTT>
                <ocpTT ocpRef="ocp-1" ocpType="pass" sequence="1" trackRef="tr3">
                    <times scope="other:goal" departure="00:00:00"/>
                    <times scope="other:interval" departure="05:03:00"/>
                    <sectionTT>
                        <trackRef ref="tr3"/>
                    </sectionTT>
                    <nor:alternativeSectionTT rank="2">
                        <trackRef ref="tr2"/>
                    </nor:alternativeSectionTT>
                </ocpTT>
                <ocpTT ocpRef="ocp-2" ocpType="stop" sequence="2" trackRef="tr7">
                    <times scope="other:goal" departure="00:07:00"/>
                    <times scope="other:interval" departure="05:07:00"/>
                    <sectionTT>
                        <trackRef ref="tr4"/>
                        <trackRef ref="tr5"/>
                        <trackRef ref="tr6"/>
                        <trackRef ref="tr7"/>
                    </sectionTT>
                    <nor:alternativeSectionTT rank="2">
                        <trackRef ref="tr4"/>
                        <trackRef ref="tr5"/>
                        <trackRef ref="tr6"/>
                        <trackRef ref="tr8"/>
                    </nor:alternativeSectionTT>
                </ocpTT>
                <ocpTT ocpRef="ocp-3" ocpType="pass" sequence="3" trackRef="tr10">
                    <times scope="other:goal" departure="00:51:00"/>
                    <times scope="other:interval" departure="05:11:00"/>
                    <sectionTT>
                        <trackRef ref="tr9"/>
                        <trackRef ref="tr10"/>
                    </sectionTT>
                </ocpTT>
            </ocpsTT>
        </trainPart>
    </trainParts>

    <trains>
        <train id="tr-1" type="operational" trainNumber="104">
            <trainPartSequence sequence="1" pathStatus="confirmed">
                <trainPartRef position="1" ref="tp-1"/>
            </trainPartSequence>
        </train>
    </trains>
    <trainGroups>
        <trainGroup id="tg-1" name="Alt3 for R10" type="other:collection">
            <trainRef sequence="1" ref="tr-1"/>
<!--        <trainRef sequence="2" ref="tr-2"/>
            <trainRef sequence="3" ref="tr-3"/>
            <trainRef sequence="3" ref="tr-4"/>
             ... -->
```

```
        </trainGroup>
        <trainGroup id="tg-2" code="R10" name="IC-tog Drammen-Lillehammer" type="interval" nor:patternTrainRef="pat-1">
            <trainRef sequence="1" ref="tr-1"/>
<!--        <trainRef sequence="2" ref="tr-2"/>
            <trainRef sequence="3" ref="tr-3"/>
            <trainRef sequence="3" ref="tr-4"/>
            ... -->
        </trainGroup>
      </trainGroups>
    </timetable>
</railml>
```

6 References

railML.org. (2018, 09 12). Retrieved from The railML.org initiative: https://www.railml.org/en/introduction/background.html

7 Attachment

7.1 Codelist <organizationalUnit>

In railML 2.4nor the following code values for Norwegian organisational units should be used. Name values are recommended values. The list can be extended by requesting Jernbanedirektoratet to update the list in future versions. In the meantime, the concerned element of <organizationalUnit> is to be used without the attribute @code.

Value of <organizationalUnit>@code	Value of <organizationalUnit>@name
MTA	LKAB Malmtrafik AB
NJM	Norsk Jernbanemuseum
GC	Green Cargo AB
SJ	SJ AB
ONR	Onrail
BN	Bane NOR SF
CN	CargoNet AS
FLY	Flytoget AS
PT	ProTrain Trafik AB
TÅB	Tågåkeriet i Bergslagen AB
HER	Hector Rail
VYG	Vy Gjøvikbanen AS
GAG	Go-Ahead Norge AS
GR	Grenland Rail AS
SJN	SJ Norge AS
VYT	VY Tog AS
VY	Vygruppen AS
DIR	Jernbanedirektoratet
NT	Nortömmer AS
BLS	BLS Rail AB
KAU	Kaunis Iron
TM	TM Togdrift AS
TMG	TM Togdrift AS Godstog
MAN	Mantena AS
NOR	Norske Tog AS