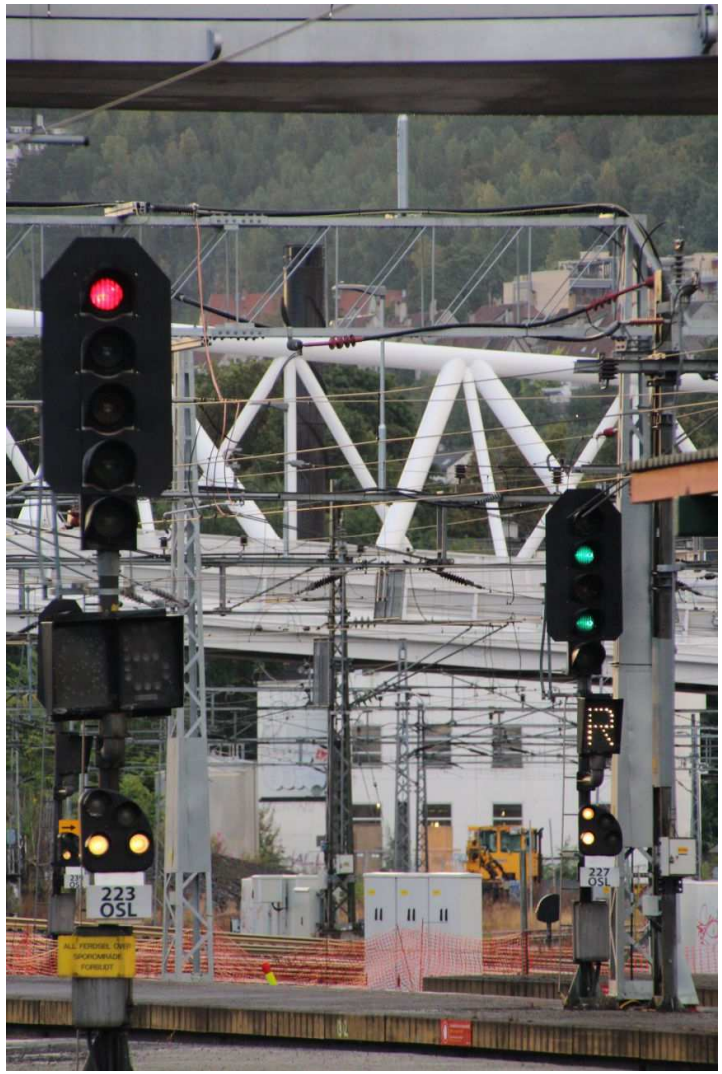
Interlocking in railML v3.2

41st railML Conference – April 26th 2022

Agenda

1. Changes in Interlocking Schema v3.2
2. Development in Interlocking Schema v3.2
3. New Elements in Infrastructure in v3.2
4. Best Practise for Documentation
5. Next steps/tasks



1. Changes in Interlocking Schema v3.2

Abbreviations in element names ➔ renaming of some main elements

- bitNr ➔ bitNumber
- SWversion ➔ softwareVersion
- lastSupervisedSectionBeforeDP ➔ lastSupervisedSectionBeforeDangerPoint

- assetsForIL ➔ assetsForInterlocking
- specificIMs ➔ specificInfrastructureManagers
- specificIM ➔ specificInfrastructureManager
- itineraries ➔ routeSequences (conflict with timetable)
- itinerary ➔ routeSequence (conflict with timetable)

but „TVD“ considered as common

1. Changes in Interlocking Schema v3.2

Restructuring at some points in schema

<AssetsForInterlocking>

- similar structure as other main elements
- with container to take various lists of assets

- Harmonising of some types with abstract classes
- ComputerNode for <controller>, <signalBox>, <radioBlockCentre>
- RouteObject in contrast to TrackAsset
- IndicatingObject for various objects used for indication on HMI
- @id only for elements where needed

- Removal of xs:any elements in schema
- custom extensions via xs:type

1. Changes in Interlocking Schema v3.2

Renaming ➔ to adhere to modelling patterns

Restructuring ➔ to simplify the modelling and harmonise type classes

Removal of xs:any ➔ to allow validation of custom extensions

Consequence:

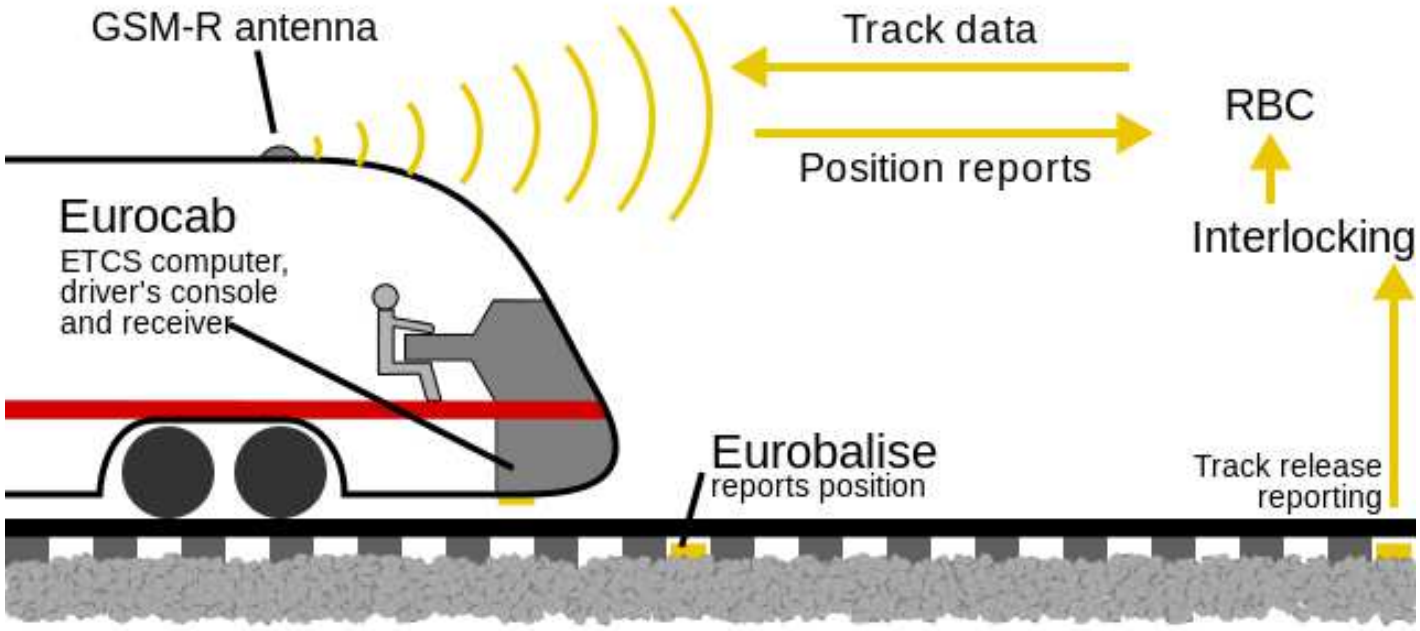
railML3.1 file with interlocking part will not validate against railML3.2 schema

Renaming and restructuring is according option 3 in post “Handling changes between minor versions“
(https://www.railml.org/forum/index.php?t=msg&th=733&start=0&)

Changes may lead to elements or attributes being removed in a new minor version, without first being deprecated. No compatibility guaranteed.

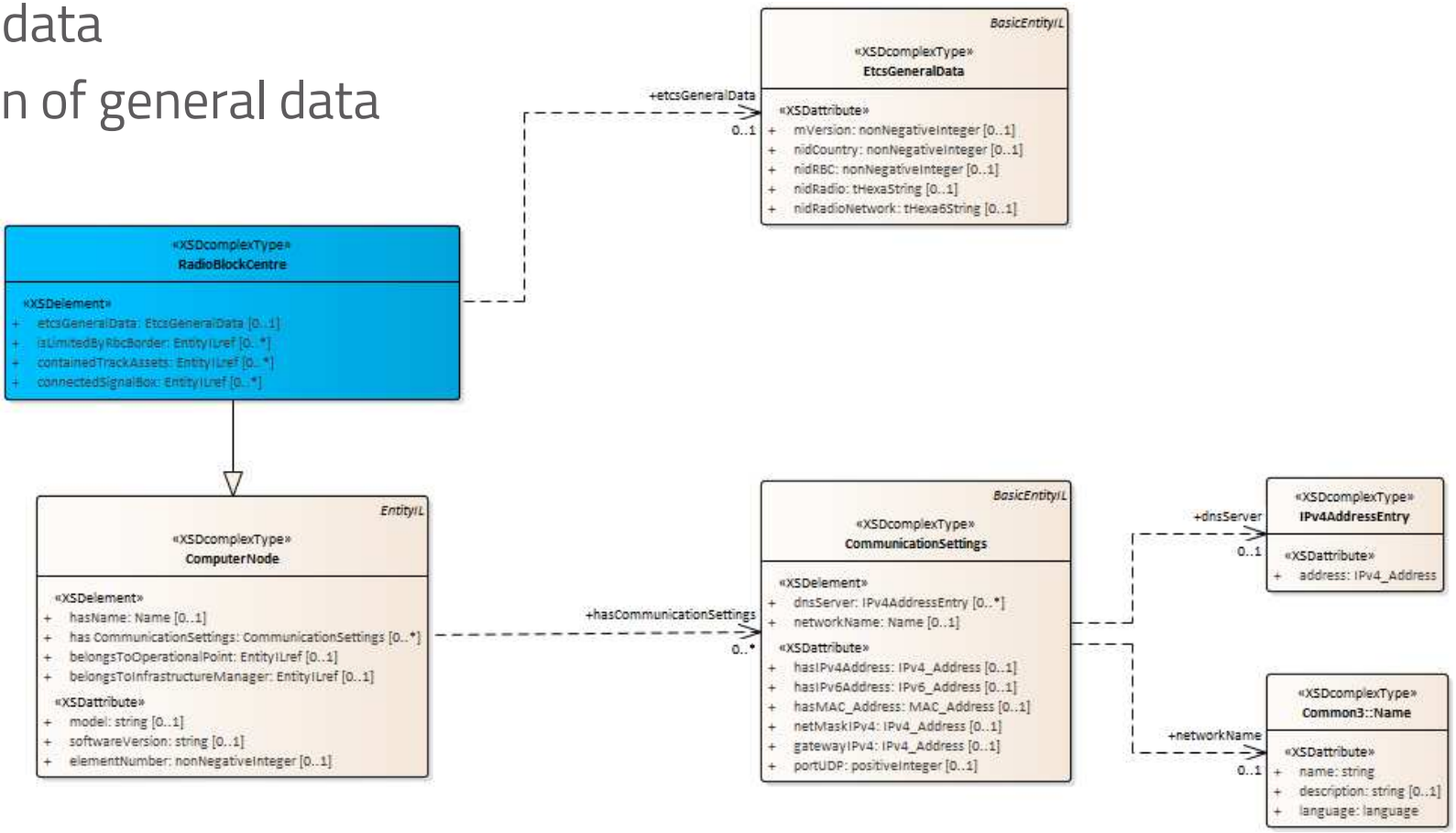
2. Development in Interlocking Schema v3.2

- Development driven from
  ➔ ETCS working group under lead of infrastructure
  ➔ needs for use case ITMS
- Forum posts



3. New Elements in Interlocking Schema v3.2

- Radio Block Centre (RBC) split on Infrastructure and Interlocking
- RBC no physical item at trackside – can be virtually everywhere
- RBC Borders need physical position in Infrastructure
- ETCS general data
- Harmonisation of general data



3. New Elements in Interlocking Schema v3.2

Referencing between IS and IL

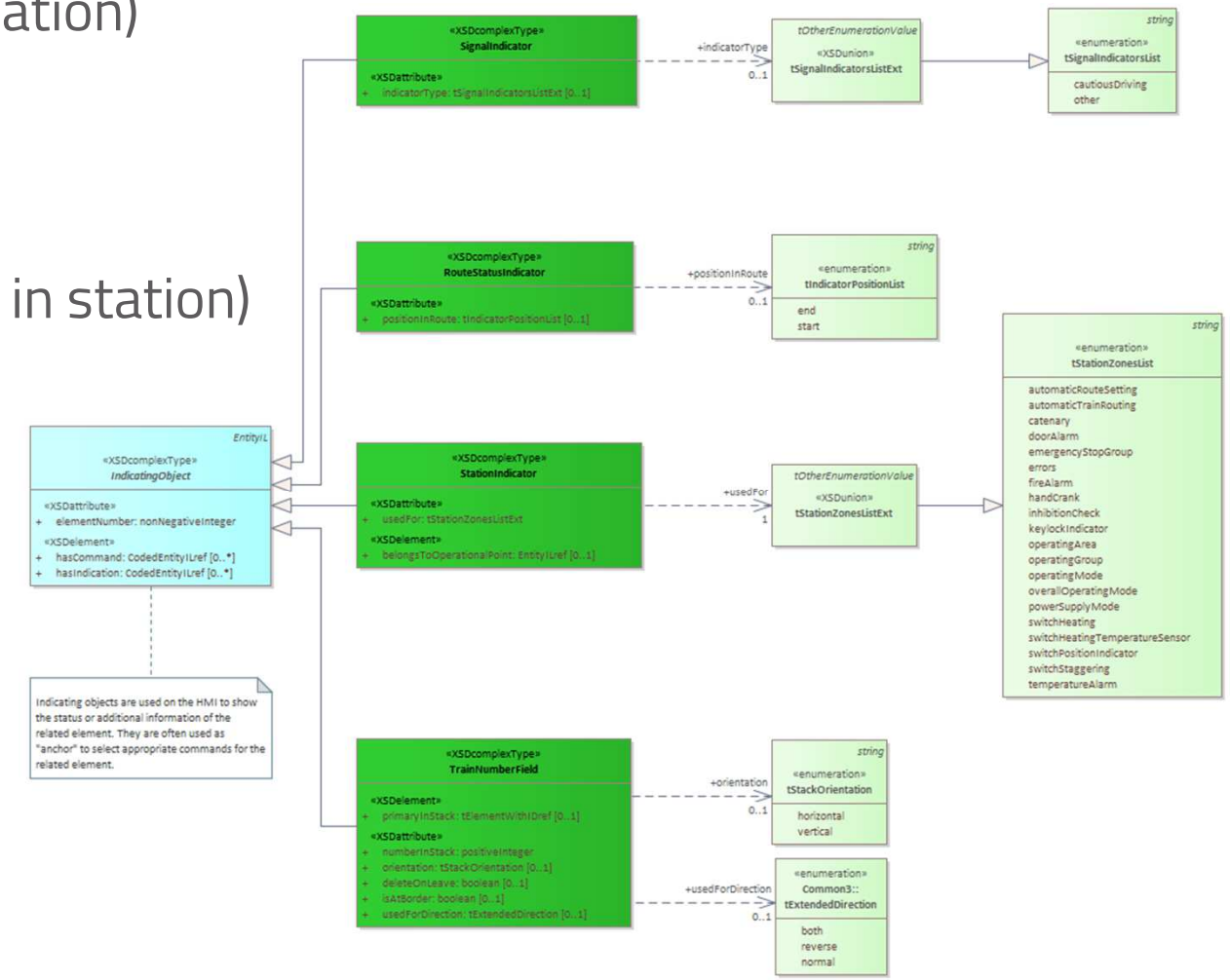
switchIS	← switchIL
derailerIS	← derailerIL
crossing	← movableCrossing
levelCrossingIS	← levelCrossingIL
keyLockIS	← keyLockIL
signalIS	← signalIL
bufferStop	← endOfTrack
track	← trackIL
underCrossing	← movableBridge
tunnelGateIS	← tunnelGateIL

…

3. New Elements in Interlocking Schema v3.2

IndicatingObjects (indication on HMI only)

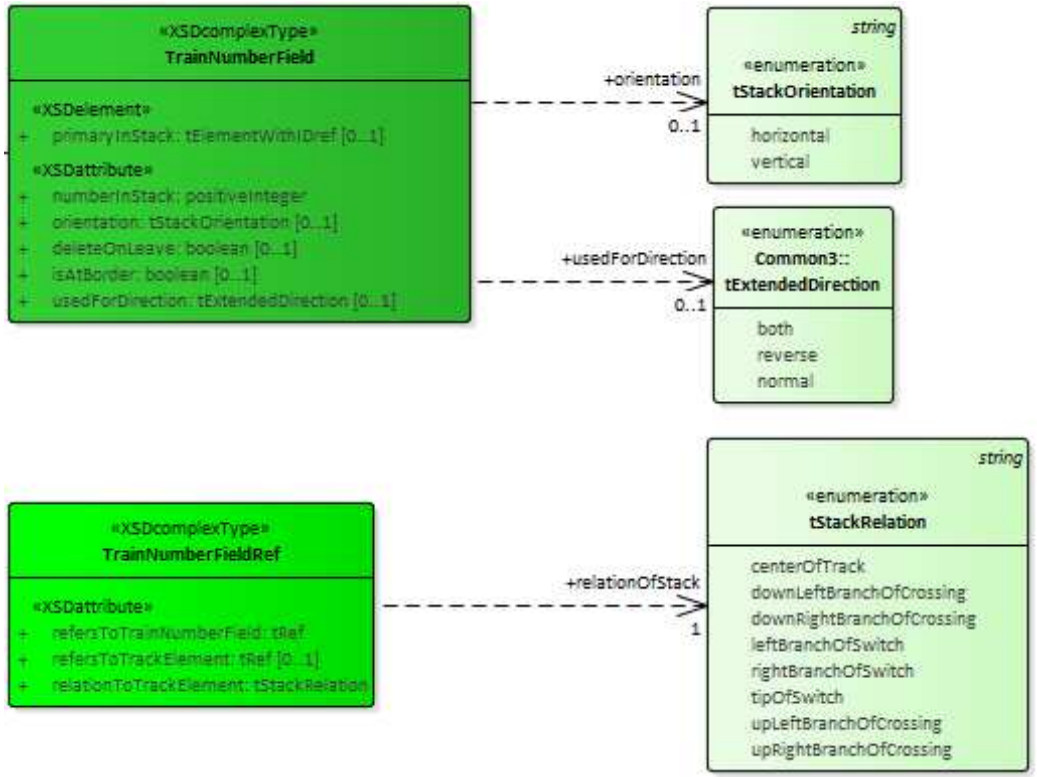
- SignalIndicator
  (additional to normal indication)
- RouteStatusIndicator
  (status at start and end)
- StationIndicator
  (status of element groups in station)
- TrainNumberField

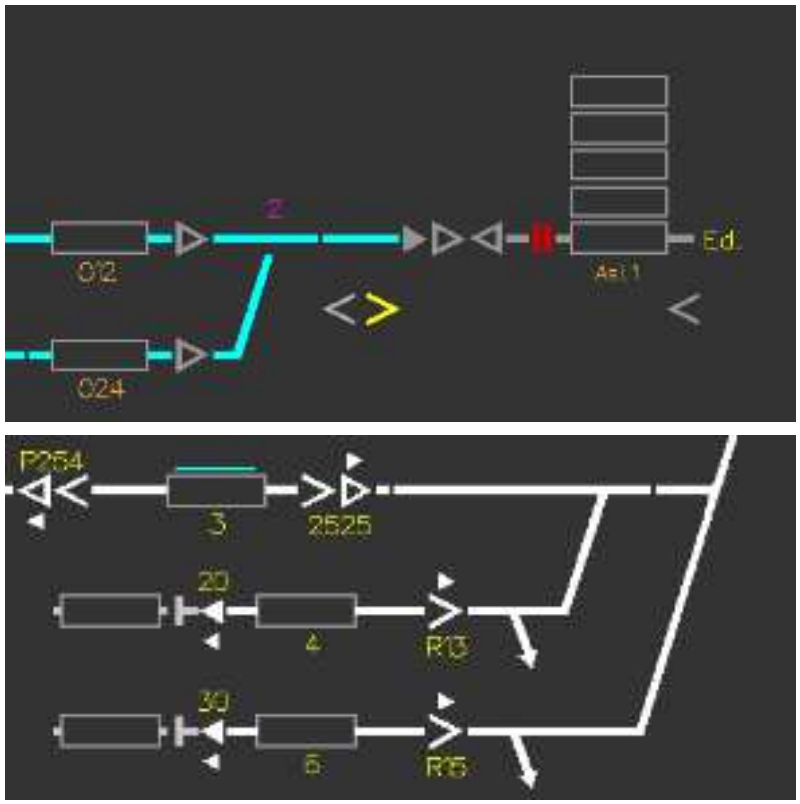


3. New Elements in Interlocking Schema v3.2

Train Number Field

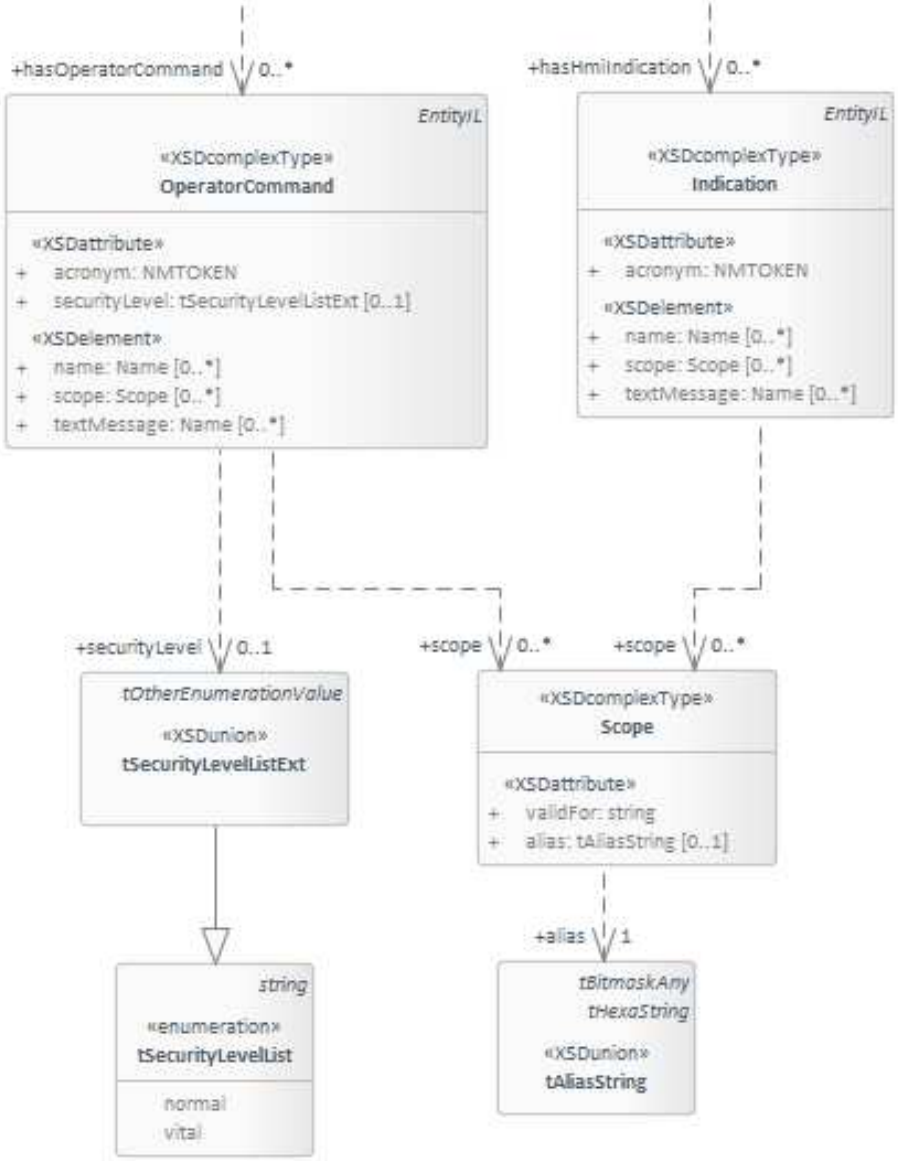
- Reference from TvdSection
- stackable, with usage direction
- static element for indication on HMI





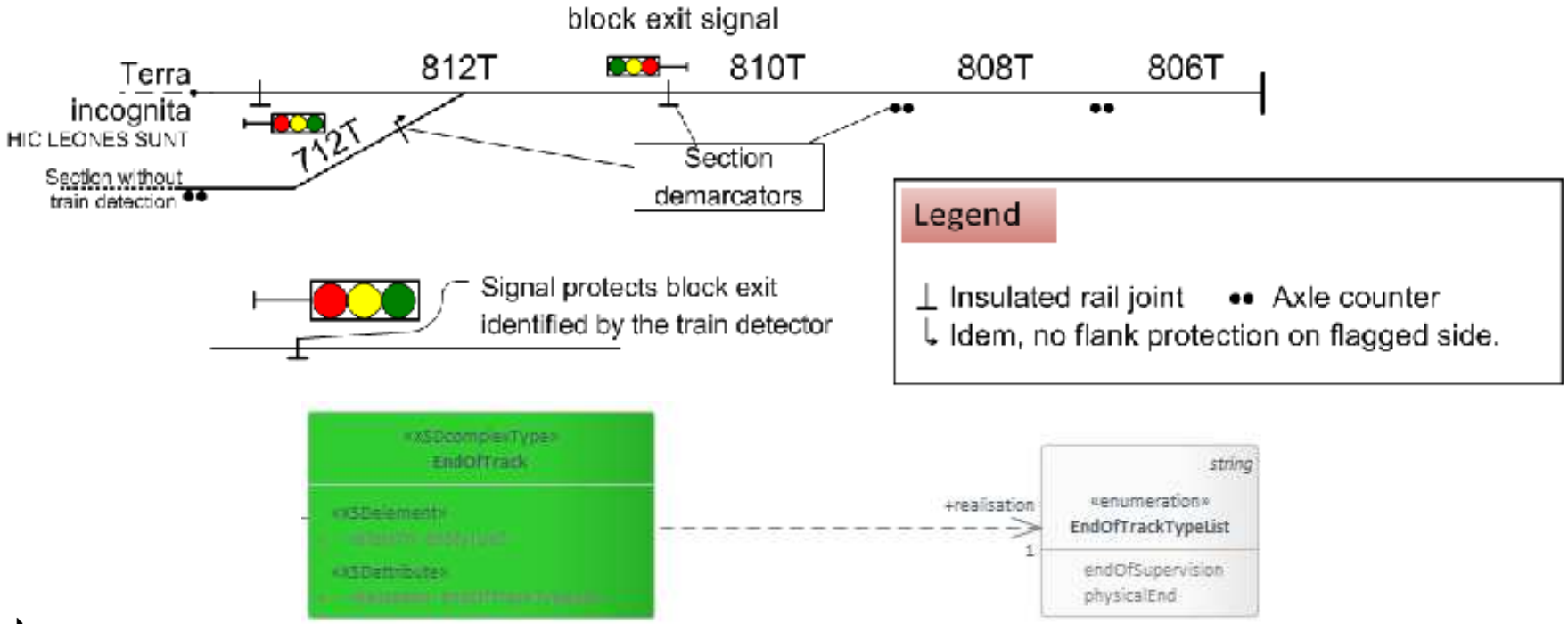
3. New Elements in Interlocking Schema v3.2

- Operator commands and indications (HMI) – ticket #451
- definition of commands and indications as "genericTypes" for a specificInfrastructureManager
- references from any element/indicator to defined commands and indications



3. New Elements in Interlocking Schema v3.2

- TrackIL
  track reference for interlocking in addition to TVD section
- EndOfTrack
  kind of border element for Interlocking purpose
  handling of physical end and limit of supervision



3. New Elements in Interlocking Schema v3.2

special infrastructure in IL - movable bridge, tunnel gates

- Similar information needed as keylock or level crossing – depending whether which positions are controlled by interlocking
- MovableBridge as LogicalDevice only locked position of interest
- Interlocking does not control the bridge drive
- No change in Infrastructure needed – Undercrossing
- TunnelGateIL with reference to TunnelGateIS
- both positions of tunnel gate supervised, with approach info

source: https://de.wikipedia.org/wiki/Datei:Pamban_Rail_Bridge.jpg

source: https://www.japan.go.jp

3. New Elements in Interlocking Schema v3.2

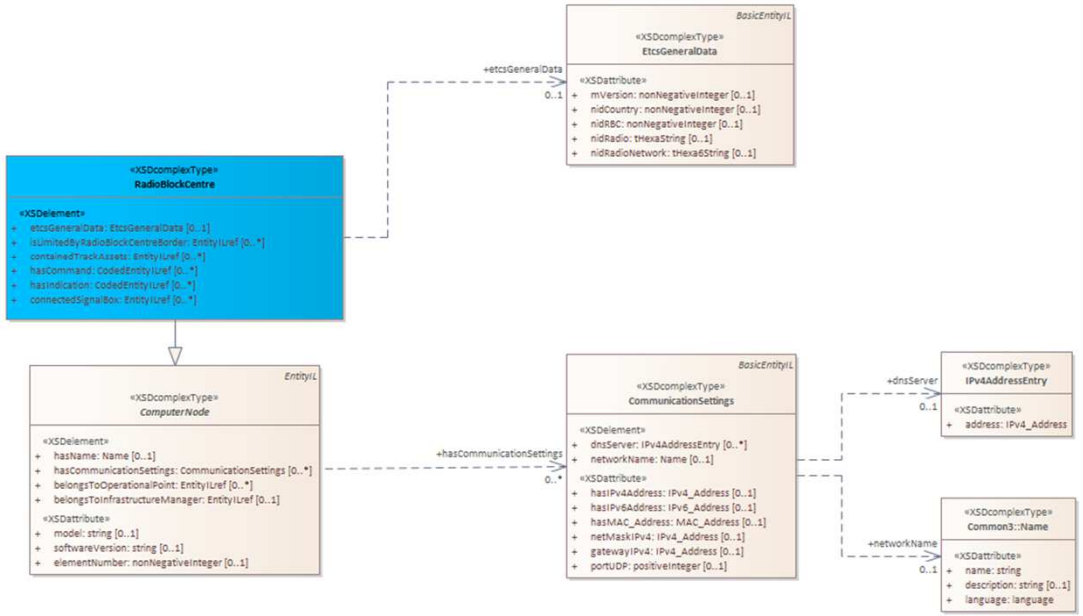
additional information

- @localOperated for movable elements like SwitchIL, DerailerIL and MovableCrossing
  ➔information, whether the element is only locally operated (electrical or mechanical)
- lockedTrack in DerailerIL
  ➔reference to the tracks, which is locked against exit by the derailer
  ➔possible relation to two tracks (derailer over two tracks)
- additionalRelation for Route and Overlap
  ➔flank protection definition

4. Best Practise for Documentation

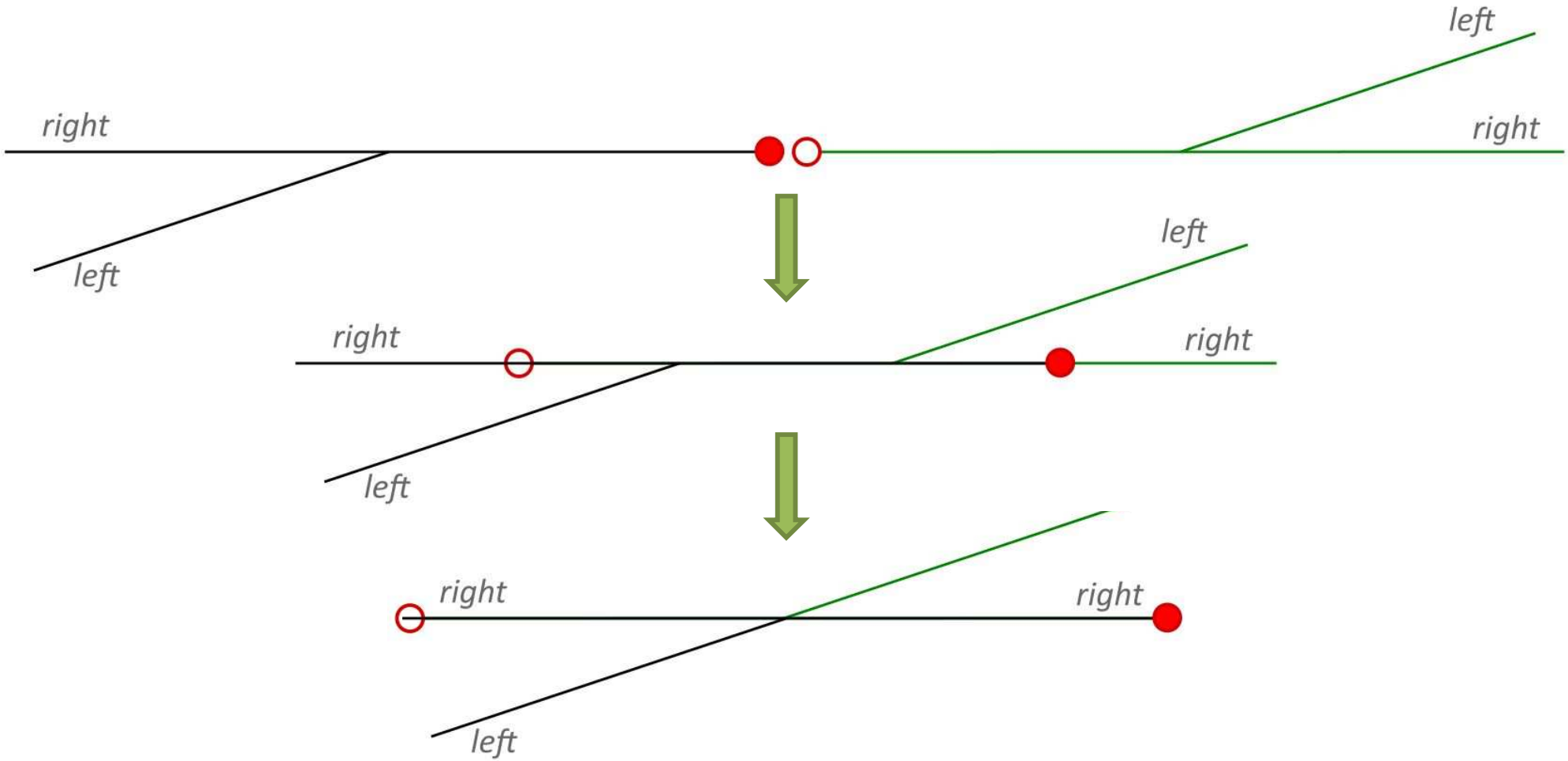
Modelling of Radio Block Centre

```
<radioBlockCentres>
    <radioBlockCentre id="radioBlockCentre2" softwareVersion="04.05" >
        <designator register="_rbcInterfaceId" entry="RbcIF:RBC2"/>
        <designator register="sci_cc" entry="GE_A00_RBC_00##0002"/>
        <etcsGeneralData mVersion="02" nidCountry="081" nidRBC="09002" nidRadio="0x0049183599900200"
            nidRadioNetwork="0x262100"/>
        <containedTrackAssets ref="tvdSection1"/>
        <containedTrackAssets ref="tvdSection2"/>
        <containedTrackAssets ref="tvdSection3"/>
        <containedTrackAssets ref="switch1"/>
        <containedTrackAssets ref="signal1"/>
        <containedTrackAssets ref="signal2"/>
        <hasCommunicationSettings hasIPv4Address="192.168.213.196" hasMAC_Address="19:16:21:19:03:05">
            <dnsServer address="192.168.176.199"/>
        </hasCommunicationSettings>
        <connectedSignalBox ref="signalBox2"/>
    </radioBlockCentre>
</radioBlockCentres>
```



4. Best Practise for Documentation

Modelling of a double slip switch



4. Best Practise for Documentation

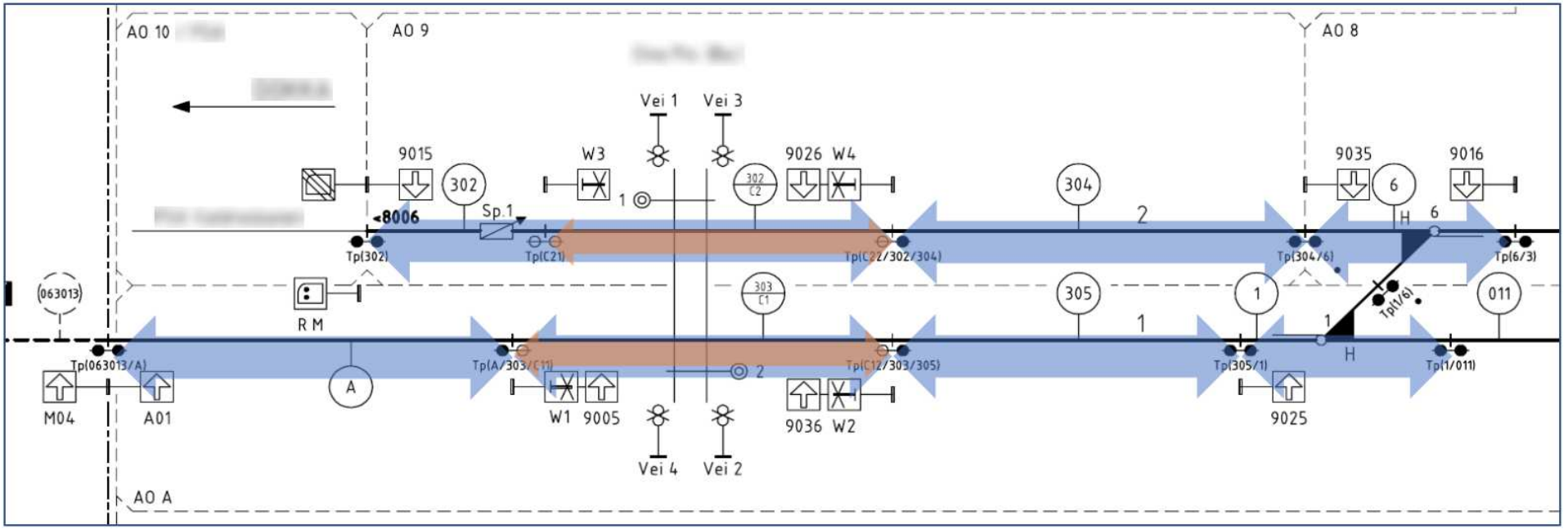
Modelling of a double slip switch

```
<switchIS id="swi_13" type="doubleSwitchCrossing">
  <spotLocation id="swi_13_sloc01" netElementRef="ne_B543" applicationDirection="both" pos="0">
    <linearCoordinate positioningSystemRef="lps_41332424-dd49-41ec-9a67-6b7a8e7209dc" measure="72122.16"/>
  </spotLocation>
  <straightBranch netRelationRef="nr_10388E_0_10392A_1"/>
  <straightBranch netRelationRef="nr_103C17_1_B543_0"/>
  <turningBranch netRelationRef="nr_10388E_0_103C17_1"/>
  <turningBranch netRelationRef="nr_10392A_1_B543_0"/>
  <switchPartition id="swip_13cd" applicationDirection="normal">
    <!--new type of node, to be applied, if a  doubleSwitchCrossing shall be operationally handled like two switches
    IDEA: May may occur once in case of a singleSwitchCrossing (in schema: 0..2). -->
    <name name="11" language="NO"/>
    <designator register="infrastructureRegister" entry="switch11entry"/>
    <!--multiple other designators should be possible-->
    <leftBranch netRelationRef="nr_10388E_0_103C17_1"/>
    <rightBranch netRelationRef="nr_103C17_1_B543_0"/>
  </switchPartition>
  <switchPartition id="swip_13ab" applicationDirection="reverse">
    <!--the second "partitionSwitch" apprears only in case of a doubleSwitchCrossing -->
    <name name="12" language="NO"/>
    <designator register="infrastructureRegister" entry="switch12entry"/>
    <leftBranch netRelationRef="nr_10392A_1_B543_0"/>
    <rightBranch netRelationRef="nr_103C17_1_B543_0"/>
  </switchPartition>
</switchIS>
```

4. Best Practise for Documentation

Modelling of a level crossing over two tracks with own detection points

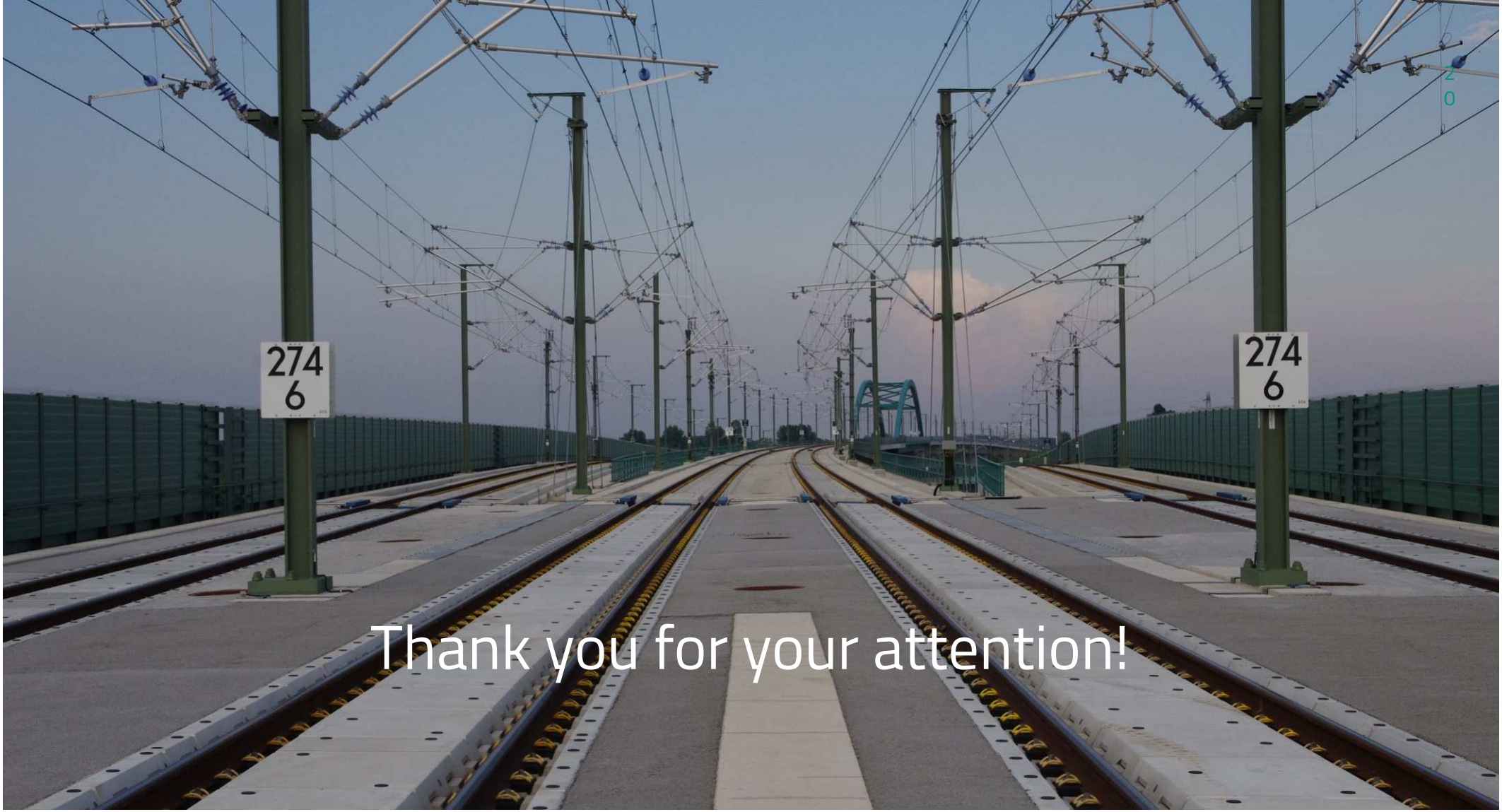
- blue sections for normal track vacancy
- red sections for deactivation of level crossing



5. Next steps/tasks

- Collection of feedback and best practise
- Enhancement of documentation in wiki
- Completion of IL part of advanced example

- Discussions on forum



Thank you for your attention!

Institut für Bahntechnik GmbH

www.railml.org

Jörg von Lingen

Interlocking coordinator

coord@interlocking.railml.org

+49-351-8775940