



INTERNATIONAL UNION
OF RAILWAYS

unity, solidarity, universality

5th UIC RailTopoModel and railML[®] Conference

*Towards a Universal Topology Model for Railways
and Data Exchange Format for Infrastructure*

UIC HQ, Paris

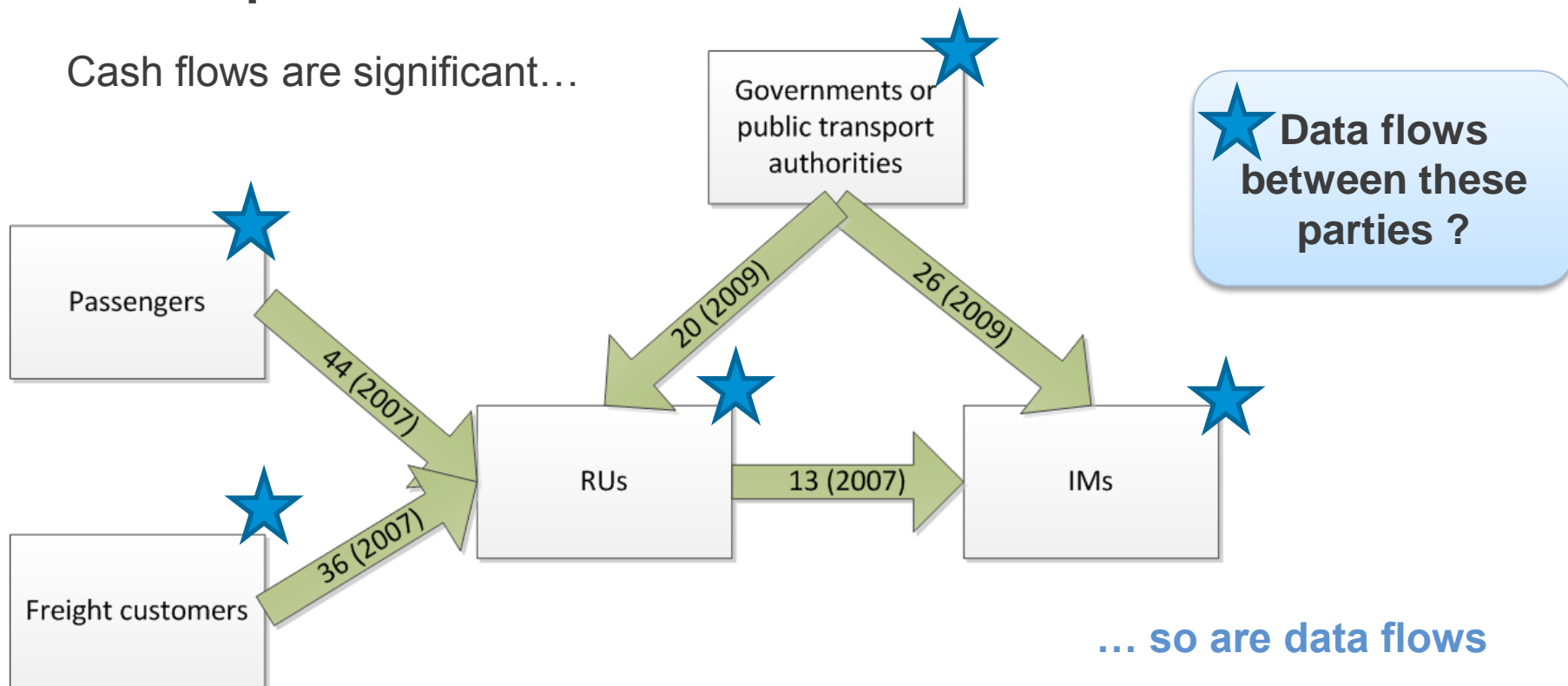
November 4th, 2015

RAILTOPOMODEL – A STEPPING STONE FOR FURTHER PROJECTS, SERVING MORE PURPOSES

Railways in Europe, still a state business

Railways, and especially railways infrastructure, remain a state-dependent business

Cash flows are significant...



... so are data flows

Observed cashflows, billion € / year, EU-wide. Amounts valid for year indicated (note: non-traffic, non-subsidy IM revenues not displayed; < 10% of total)

Several instruments for several purposes

> Strategic planning: flow = IM to Authorities

Main technical features + operational usage

→ TransTools model & successor projects (JRC)

→ TENtec information system by INEA
(Innovation and Networks Executive Agency)

> Track Access: flow = IM to RU or end Customers

Technical, commercial and legal conditions for access

→ Network Statements (one per IM)

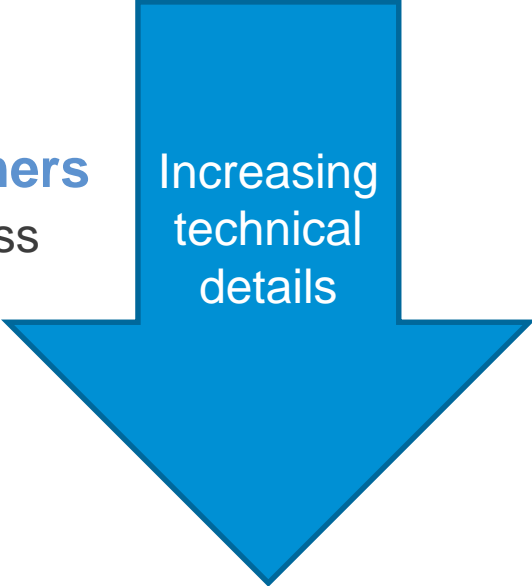
> Conformity: flow = IM to Authorities

Measure compliance with TSIs

Measure progress of interoperability

Enable ex post analysis and policy improvement

→ Registers: RINF, Inventory of Assets



Increasing
technical
details

Challenge: multiple outputs, update burden

Not just IM to Authorities

Register of Infrastructure raises growing interest

1996: Initial purpose...

- Conformity declaration, by subsystem
- Monitoring progress of interoperability

2011: EU Decision

- Conformity declaration, all subsystems (INF, ENE, CCS)
- Monitoring progress of interoperability
- Verification of compatibility with fixed installations
- Ascertaining route compatibility for trains
- Designing Rolling Stock
- ...Providing transparency

How to realize the potential?

IM to RU: Network Statements

Purpose: provide technical and commercial access conditions to network

Legal basis

Created, Dir. 2001/14
Detailed, Dir. 2012/34 (Annex 4)

Implementation

2001: UIC Network Statement WG
2004: RailNetEurope takes over
[Network Statement Common Structure](#) (2002-2015, ongoing)

Network Statements for the Railways of Europe

The 'open access' policy implemented by the European Commission envisages competition among Railway Undertakings. This requires easy and fair access to comprehensive, up-to-date and open information about rail networks. Directive 2001/14/EC therefore introduced the obligation to publish a network statement at regular intervals and defined the basic requirements to be fulfilled by the document.

What is a network statement?

Network statements are a direct line from Infrastructure Managers / Allocation Bodies to customers and a starting point for the provision of competitive rail services in the emerging European railway area.

They are key to market access, since they summarise all relevant information on the rail infrastructure 'product': how to obtain access to it, what are its characteristics (in the different sections of the network), how much of it is available (infrastructure capacity), what is the timing for requesting it, what is its price, etc.

What type of information will you find in a network statement?

Network statements contain all the information that a Railway Undertaking requires to prepare a business case for a new rail service:

- > a general description of the rail infrastructure,
- > legal access conditions: principles, criteria and procedures for the allocation of train paths – incl. transparent provisions for ad-hoc capacity requests and,
- > commercial access conditions (e.g. infrastructure charging principles together with tariffs for the different services).

Network statements are designed to ease access to rail networks. Essentially, they are commercial documents. Detailed technical data is/will be provided in the Infrastructure Register in each country.*

*Directive 2008/57/EC sets out in Art. 35 (1) the obligation for Member States to ensure that a Register of Infrastructure is published and updated, indicating the main features of each subsystem or part subsystem of the rail system and their correlation with the features in the applicable Technical Specification for Interoperability (TSI).

How easy is it to find the information you need?

In order to increase the customer-friendliness of network statements, as well as their consistency across Europe, RNE has already harmonised the way they are structured: a *Common Structure* is in place since 2001, with updates/reviews being done each year (the last one in 2011), dividing NS into 6 main chapters (see snapshot to the right). In addition, RNE published an *Implementation Guide* for drafting network statements in accordance with Art. 3 of Directive 2001/14/EC – this guide is integrated in the Common Structure.

Number of chapter / sub-chapter	Heading	Implementation guide	Remarks (version control)
	Main Sections The following headings have been agreed to the members of the Network Statement WG. Content: Last NS is obligatory to provide information regarding the network information regarding neighbouring networks. Network information of the quality required in Annex I of Directive 2001/14/EC should be provided. The information to be provided includes all applicable in its administrative scope services, not general areas, but applicable and available services. The information to be provided should be available and up-to-date. It should be provided since 1st January 2002 and in full.	Content: Last NS is obligatory to provide information regarding the network information regarding neighbouring networks. Network information of the quality required in Annex I of Directive 2001/14/EC should be provided. The information to be provided includes all applicable in its administrative scope services, not general areas, but applicable and available services. The information to be provided should be available and up-to-date. It should be provided since 1st January 2002 and in full.	Updated in 2011
	VERSION CONTROL	All previous versions of the agreed document should be identified, together with a brief description of the changes.	
	TABLE OF CONTENTS		
1	GENERAL INFORMATION		
2	ACCESS CONDITIONS		
3	INFRASTRUCTURE		
4	CAPACITY ALLOCATION		
5	SERVICES		
6	CHARGES		
	INDEX		

contains remarks, mostly about modifications of the Common Structure

the main chapters of the agreed Common Structure

Source : RNE website

Example Clearance gauge: data access and display

❑ Amongst 37 network statements:

- 18 do not provide clearance gauge maps
- 8 do not follow UIC 506 (interoperable gauge)
- Only 8 present data for the combined transport (UIC 596-6)

❑ 6 IMs offer GIS access to infrastructure data

- But information is not necessarily complete

❑ Clearance gauge data are in annexes

... often not translated, and certainly not machine-readable

... not usable for exceptional transports

➔ Need to improve and speed up

IM to Authorities : Directive 2012/34

From recitals:

- (67) To enable the establishment of appropriate and fair levels of infrastructure charges, infrastructure managers need to record and establish the value of their assets and develop a clear understanding of the factors which determine the cost of operating the infrastructure.

From Art. 30:

7. Infrastructure managers shall develop and maintain a register of their assets and the assets they are responsible for managing which would be used to assess the financing needed to repair or replace them. This shall be accompanied by details of expenditure on renewal and upgrading of the infrastructure.

Link with traffic and revenue: not explicitly dealt with
Asset management dimension requires it!

IM to Authorities and Public: Inventory of assets

> Subject is station accessibility to People with Reduced Mobility (PRM) - Two functions imposed by PRM TSI:

General information about progress of accessibility → target: authorities
Trip-related information → target: (potential) passengers

> Several ways to implement the functions

Via national or company solutions → work duplication

Via telematics for passengers (TAP TSI) → in some future

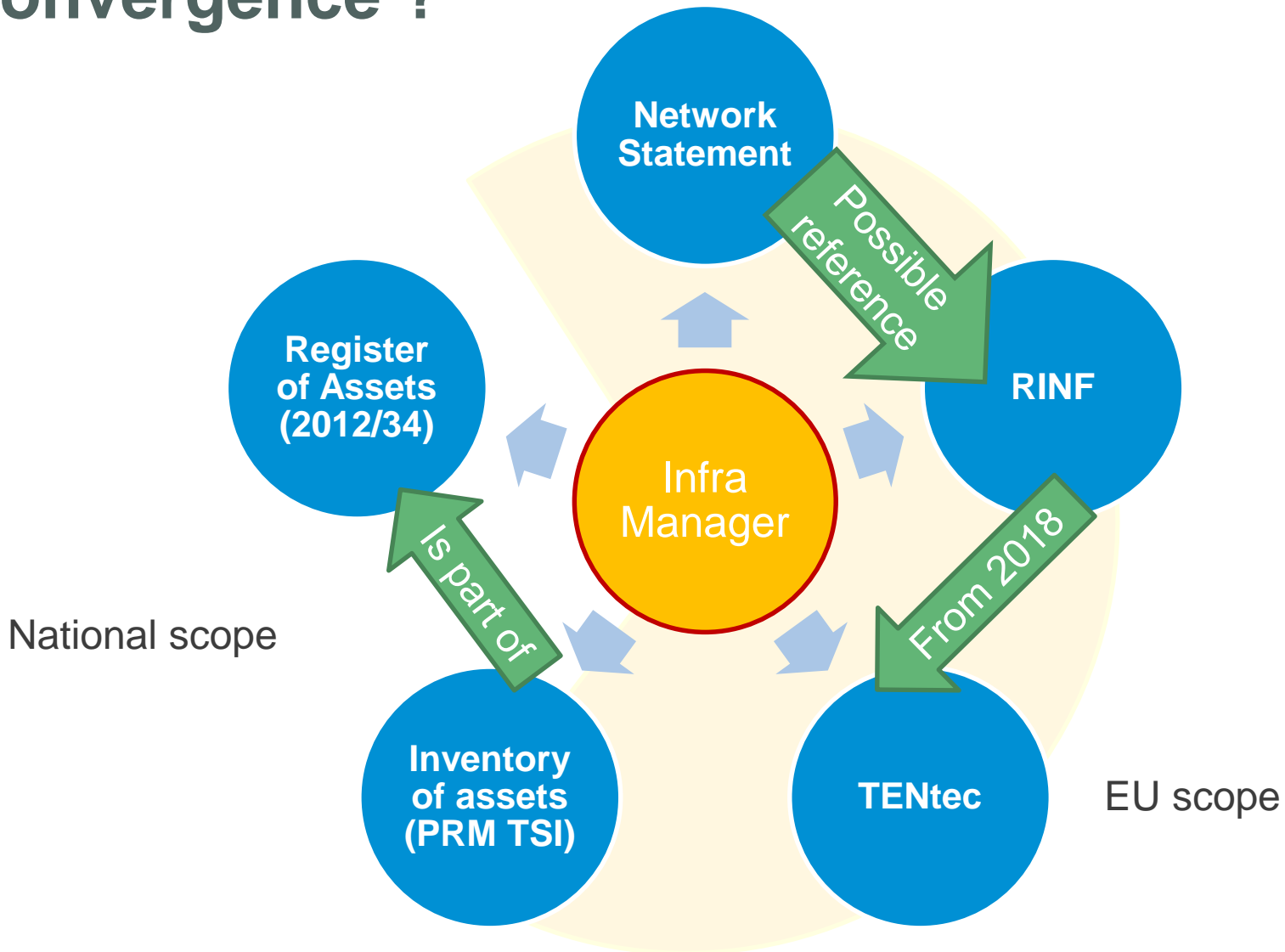
Via dedicated solution → ongoing EU tender

> Modeling is key – no matter the solution

EN 28701:2012 (*Identification of Fixed Objects in Public Transport*) provides adequate passenger path description **inside stations**

Provide consistent, reliable start-to-end trip information
→ *Need to interface EN28701 with the RailTopoModel, and extend railML[®] 3 accordingly*

Convergence ?



> **Data structure**

RailTopoModel (UIC project, 2013-2015)

Universal network representation

Iron network + whatever it supports:

Material elements (signals, switches, ...)

Immaterial elements (timetables, track possessions...)

IRS 30100 (release candidate 11/2015, official release 4/2016)

Asset management extension (2016) to deal with

Life cycle costing

Wear & tear laws

> **Data exchange format**

railML[®] 3, conforming the RailTopoModel

Compatible with RINF (railML[®] to RINF converter)

> **Applications: projects**

NeTIRail (H2020 project); GRIDS (UIC, from 2016)



...Thank you for your attention

magnien@uic.org



railML[®] 3.0 MockUp

Overview



- > Current state of the model
- > Current state of the use cases
- > Roadmap

railML[®] 3.0 MockUp Model



> Modular structure

Topology

Coordinates *[optional]*

Track Geometry *[optional]*

Railway Infrastructure Elements *[optional]*

##other

> Generic structure for locating elements within the topologic network

Applies for all elements of

Track Geometry and

Railway Infrastructure Elements

railML[®] 3.0 MockUp Model



> Topology

Nodes

- Track Nodes
- Operational Points

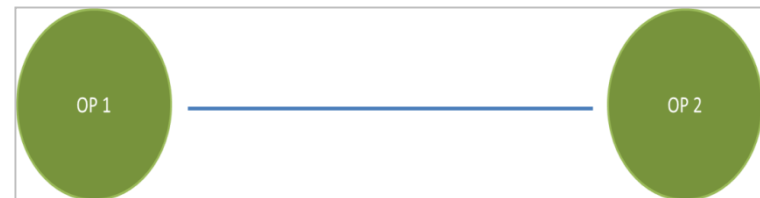
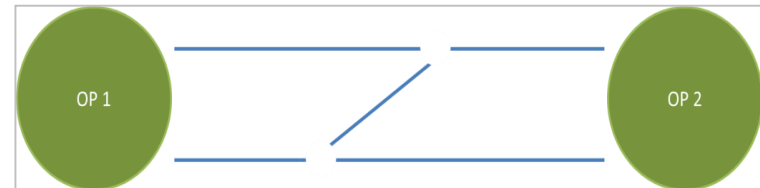
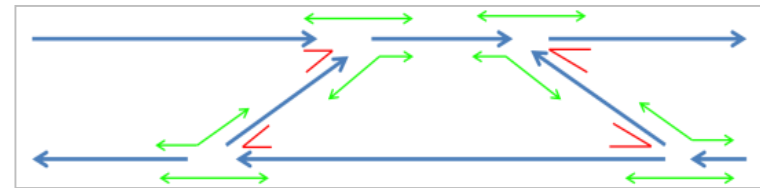
Edges

- Tracks
- Sections of Line
- (Lines)

Connections

Networks *[optional]*

**Topology is based
on RailTopoModel**



Figures: UIC RTM Modeling group

railML[®] 3.0 MockUp Model



> Coordinates *[optional]*

Geographic coordinates

- Implemented as GML elements
- Spot elements, Nodes: **<geoPoint>** (gml:PointType)
- Linear elements, Edges: **<geoLine>** (gml:LineStringType)

Linear coordinates

- Mileage: reference to line, mileage value

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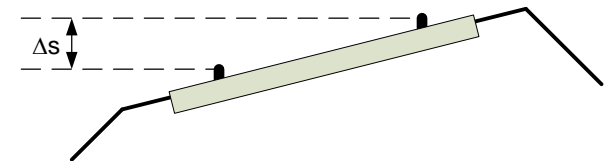
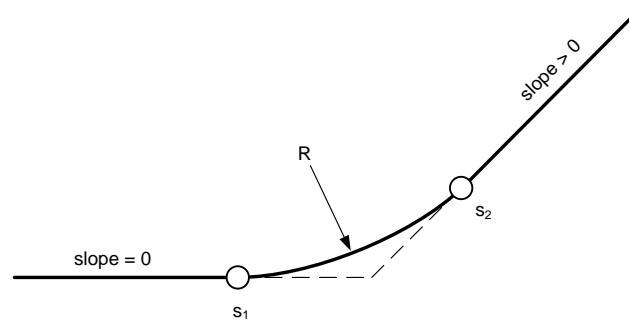
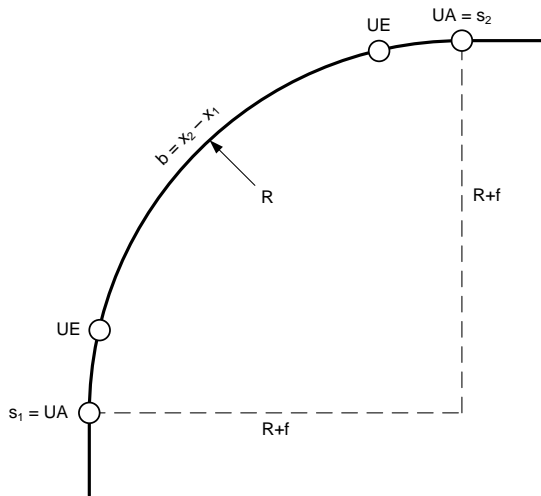


> Track Geometry *[optional]*

Horizontal curves → radius

Gradient curves → gradient

Superelevation curves → superelevation / cant



Figures: railML.org

railML[®] 3.0 MockUp Model



> Elements *[optional]*

Electrification sections

- voltage, frequency, electrification type

Speed profiles

- Define specific constraints influencing the permitted speed

Speed restrictions

- vMax, reference to speed profile

Speed changes

- Define specific points on the track where permitted speed changes

Level crossings

Platform edges

Train protection elements

- medium, train protection system, model

Tunnels

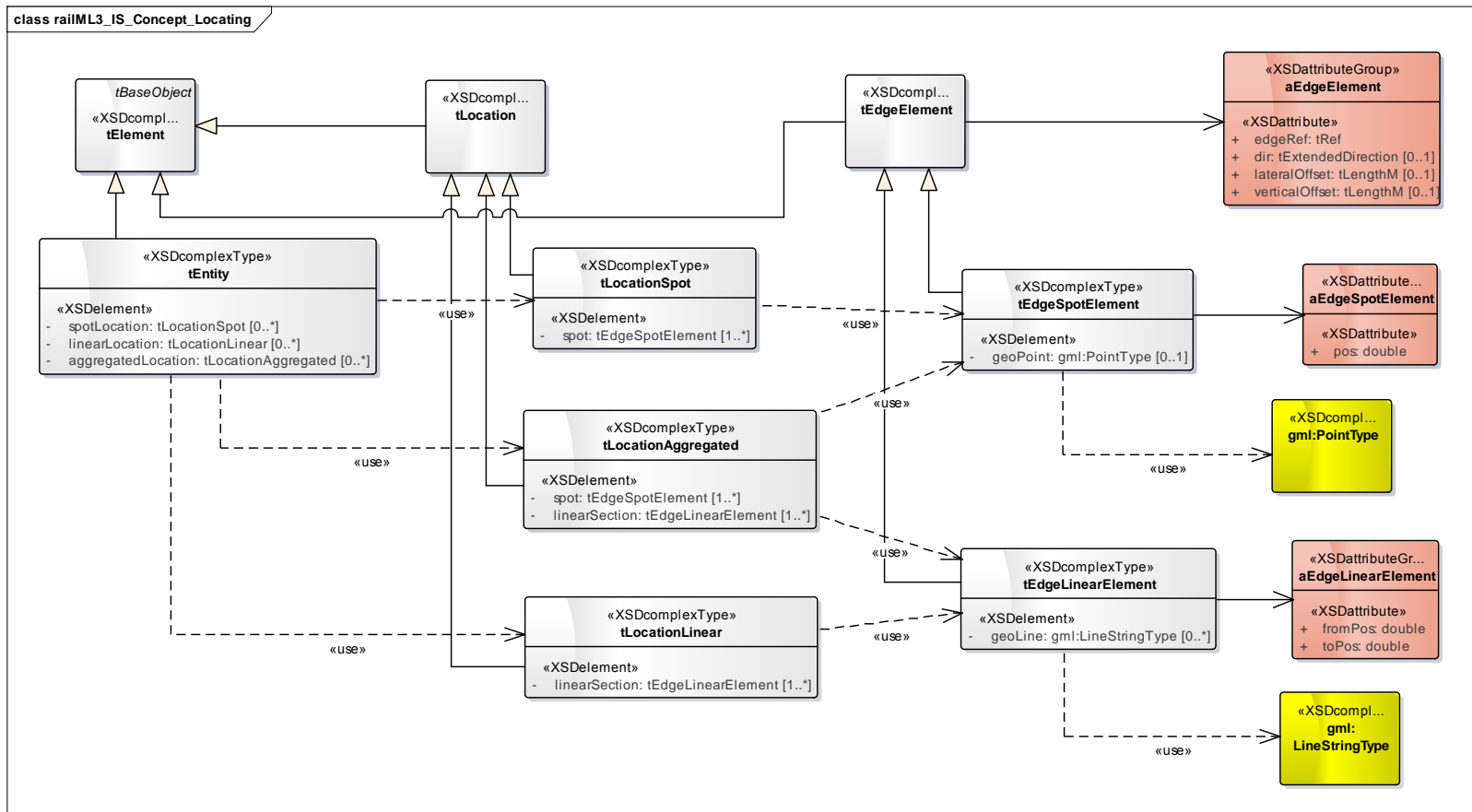
##other

> Generic concept of locating elements

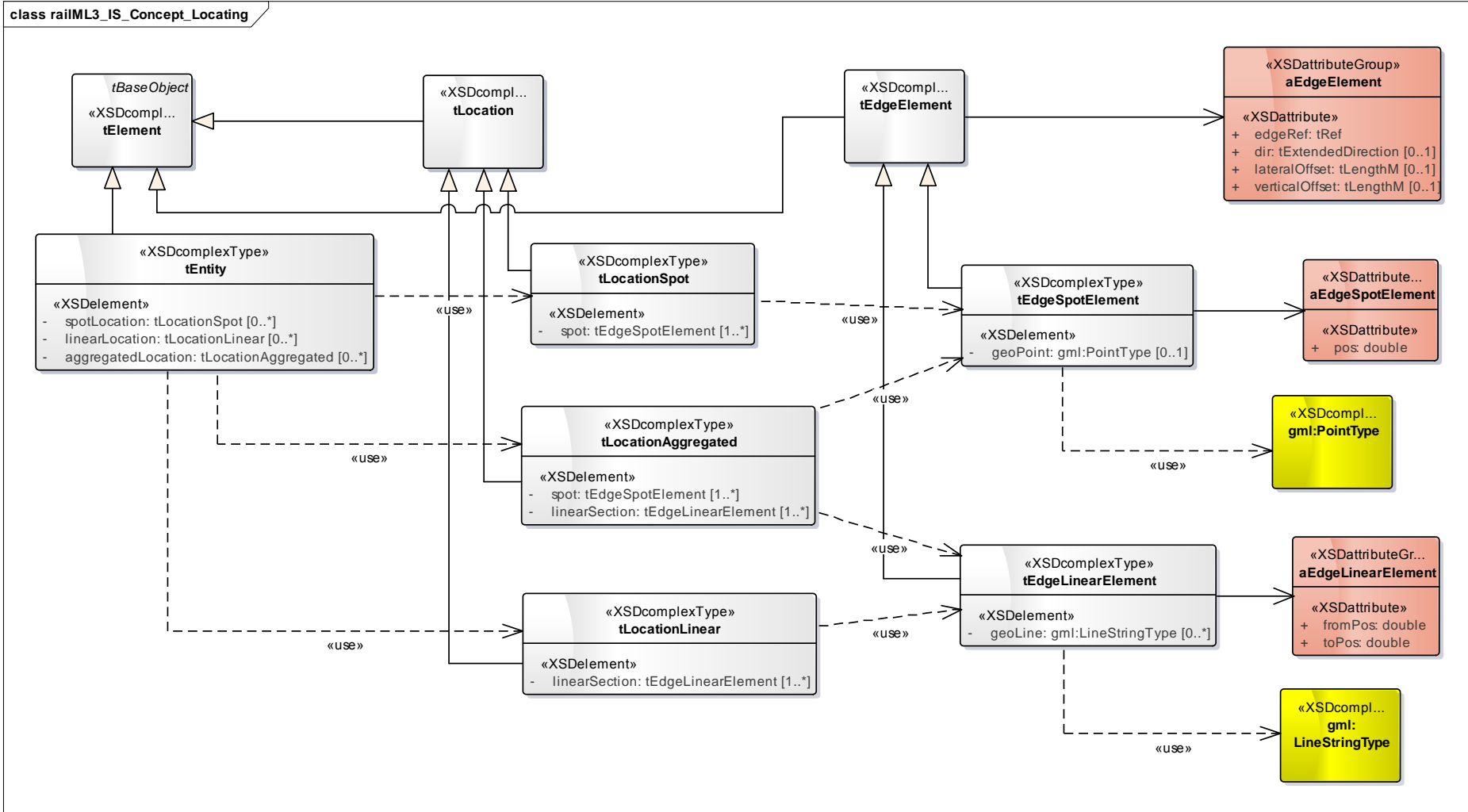
Principles:

- All elements may exist independent of any topologic or geometric position
- An element may have multiple locations in the topologic network (e.g. one location per aggregation layer)
- While being placed as linear element on microscopic level, the same element may be modelled as spot element on macroscopic level
- A spot location refers one point on an edge of the topologic network
- A linear location refers to an ordered set of edges or part of edges
- An aggregated location refers to a collection of spot and linear locations
- A spot on the edge of the topologic network can be linked with a GML point type coordinate
- A linear section on the edge of the topologic network can be linked with a set of GML line string type coordinates

> Generic concept of locating elements

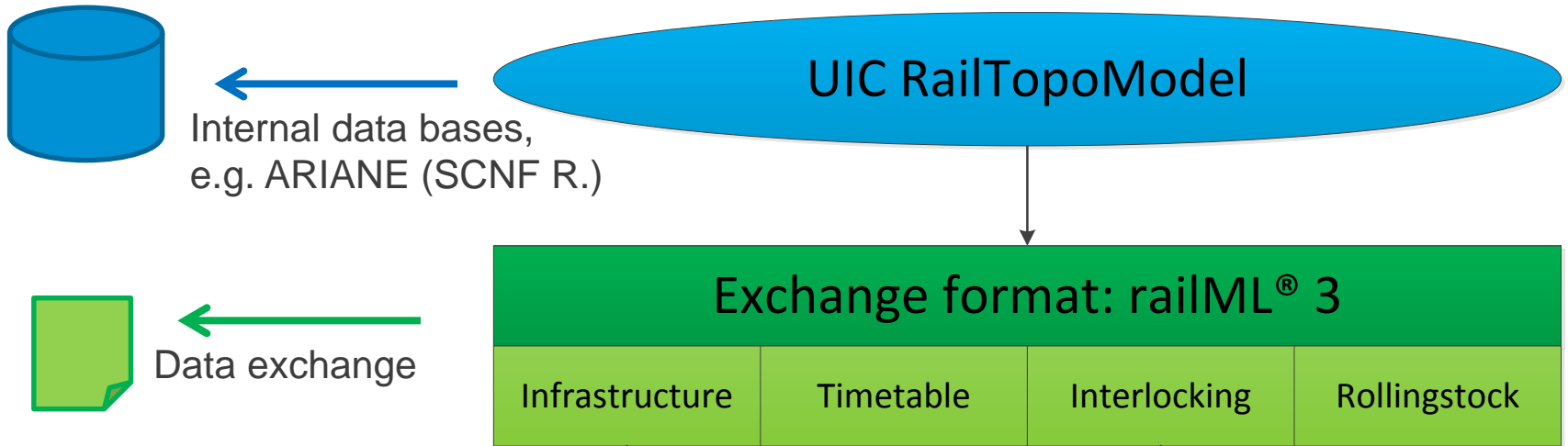


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railML[®] 3.0 MockUp

Use Cases

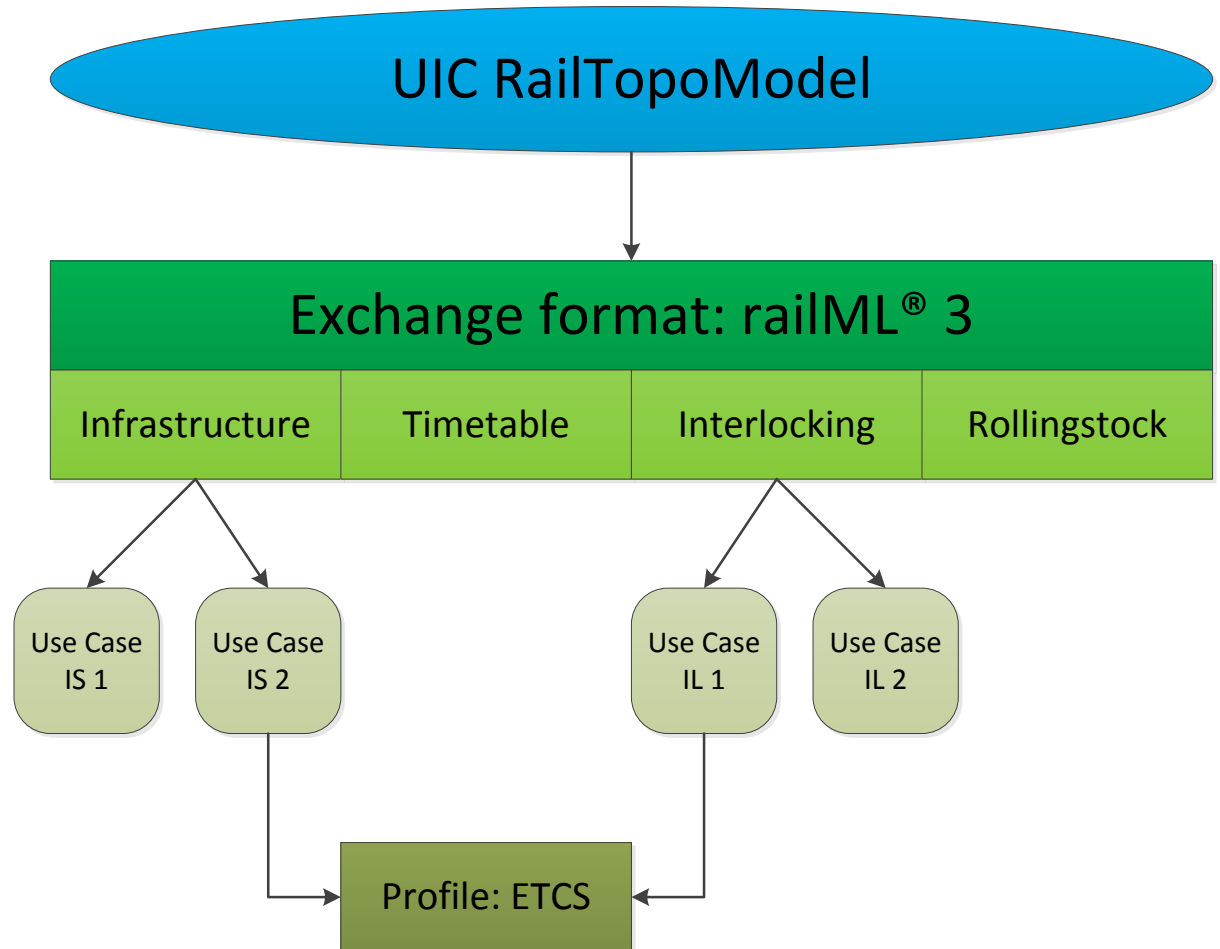


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Use Cases



> Concept:



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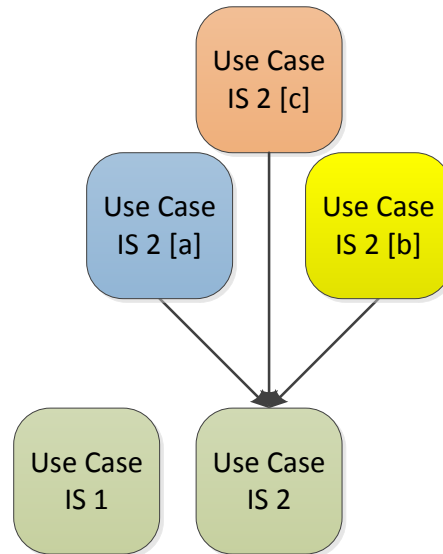
Use Cases



> Concept:



We encourage you to provide us your data exchange use cases!



The railML[®] schema coordinators review all use cases and create generic samples

railML[®] 3.0 MockUp

Use Cases



> Use case:

Description: application behind the use case

Data flows and interfaces

Interference with further railML[®] schemas

Characterizing data

- How often do the data change (update)?
- How big are the data fragments to be exchanged (complexity, granularity)?
- Which views are represented by the data (focus)?
- Specific elements

railML[®] 3.0 MockUp

Use Cases



> MS Word template

Old

> Wiki page

New

Development of the railML[®] 3 schemes
Definition of use cases for infrastructure data

railML[®]

Use case / Anwendungsfall / Scénario d'utilisation: XXX

Description / Beschreibung / Description

What is the application behind the use case? Which data are required? Who or which tool/application provides these data? Which data are not included (if not obvious)? Define the boundaries of the use case and the relevant data. (max. 200 words, English)
[...]

Data Flows and Interfaces / Datenflüsse und Schnittstellen / Flux de données et interfaces

Which data flows (from/to the use case application) exist? Which data and process interfaces exist?
[...]

Interference with other railML[®] schemas / Interferenz mit anderen Schemen / Interaction avec

timetable interlocking rolling stock none

Characterizing Data / Charakterisierung der Daten / Caractérisation des données

This section serves to specify the required data regarding certain aspects.

How often do the data change (update)?

railML[®] 3.0 MockUp

Use Cases



> Infrastructure use cases:

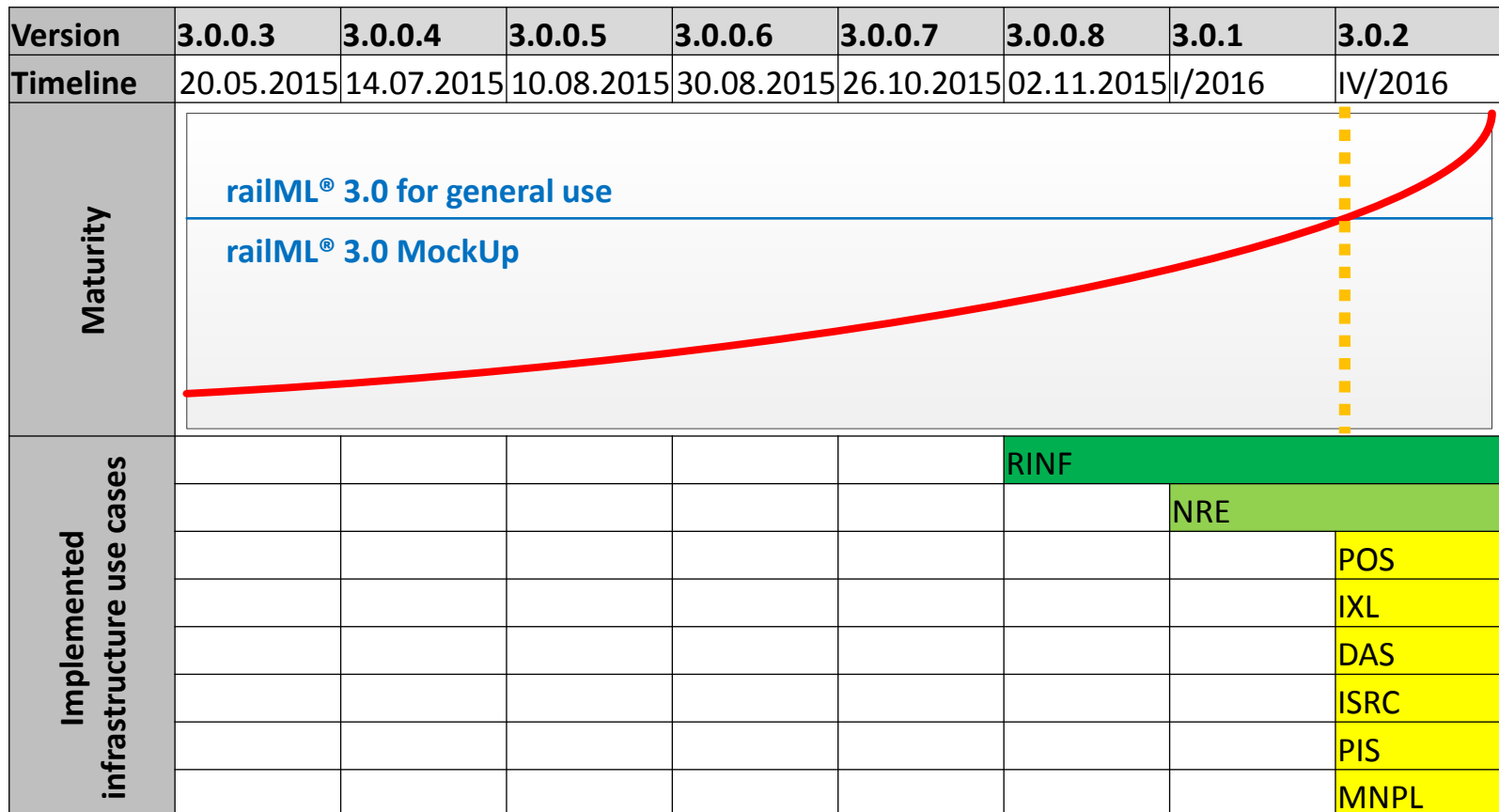
Use Case	Responsible	State
RINF	SNCF Réseau	Implemented
NRE Reporting (NRE)	ÖBB	Scheduled
ETCS	Infrabel	Later
Speed Directory (SPDI)	ÖBB	Later
Capacity Planning (CAPL)	Jernbaneverket	Later
Positioning System (POS)	DLR	Ready
Interlocking (IXL)	DB	Ready
Driver Advisory System (DAS)	Network Rail	Ready
Infrastructure Recording (ISRC)	Bahnkonzept	Ready
Passenger Information (PIS)	BLS	Ready
Maintenance Planning (MNPL)	SBB, BLS	Ready

railML[®] 3.0 MockUp

Roadmap



> Roadmap...



■ ■ ■ Thank you for your kind attention



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Figure: Shutterstock