

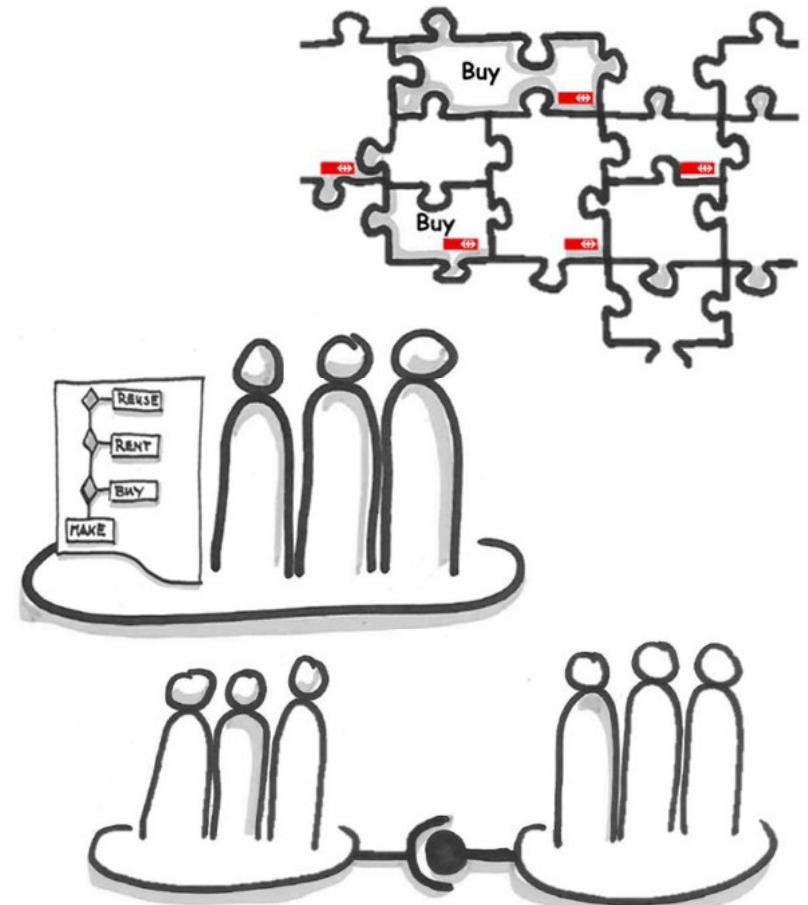
Using railML® for Exchanging Timetable Data

Experiences from the PAIP Project

Alexander Schmidt
Paris, May 3, 2017

Architecture Principles at SBB.

- Reuse, Rent, Buy or Make for new applications
- We share and use data across the entire SBB enterprise
- «Rent» or «Buy» is to be preferred in comparison to in-house/proprietary development
- Requirements on integration are increasing



Defined Goal of SBB Infrastructure's IT.

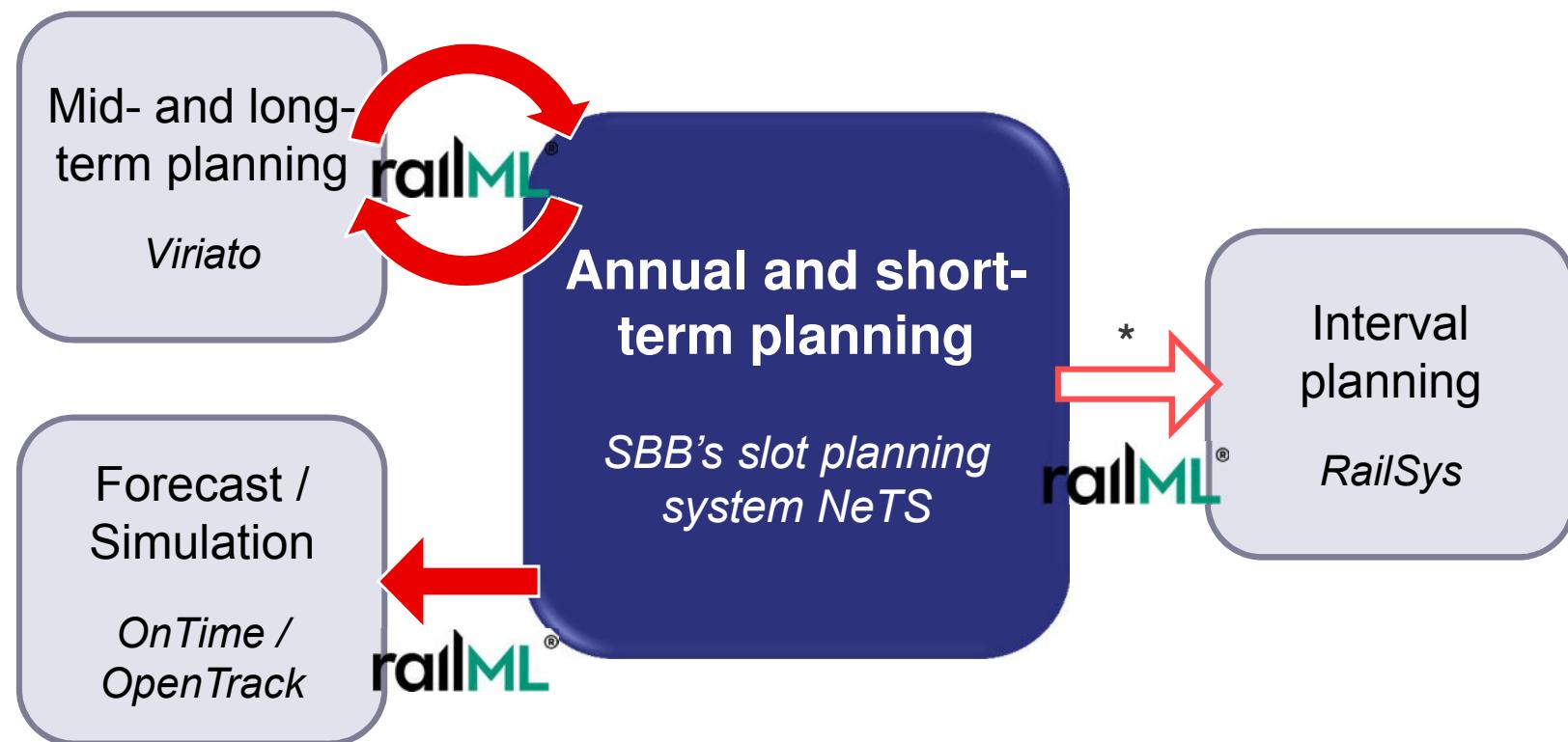
- SBB IT aims at actively driving standardisation of its application integration.
- railML® / RailTopoModel is considered of having the potential – both from a business as well as from an IT perspective – to become an essential format for the standardised exchange of infrastructure data.
- In 2017 SBB Infrastructure's IT is willing to demonstrate the potential and benefit of railML® / RailTopoModel, with the help of concrete projects and proof of concepts.



Jürg Balsiger, Head of IT Solution Center Infrastructure:

*« In 2017 we want to detect the actual potential
of railML® / RailTopoModel for SBB. »*

Current Use of railML® (1/2).



* planned

Current Use of railML® (2/2).

- Rail Control System (RCS) is using railML® in order to archive production data.
- In NeTS (Net-wide Slot System) railML® is applied for the export of single slots with a minimum number of attributes being used by tracks.

With the Project PAIP a new interface is to be implemented using railML® 2.3 / 2.4.

Project «PAIP».

- **Process Alignment Interval Planning**
- Interval = restriction of capacity due to construction activities (suspension, speed restriction section)
- Support and improve planning process of closures in infrastructure
- Integration of a “commercial off-the-shelf” software in the field of capacity planning
- Data exchange between proprietary SBB applications and external (third-party) software
- Exchange of more than 200'000 slots per year
- Modernisation of the existing railML®1.0-interface

Project «PAIP».

- railML® covers about 60-80% of our requirements
- Remaining coverage is ensured by proper extensions
- Major challenge consists the semantic significance of attributes
- Early contact with the railML® timetable community

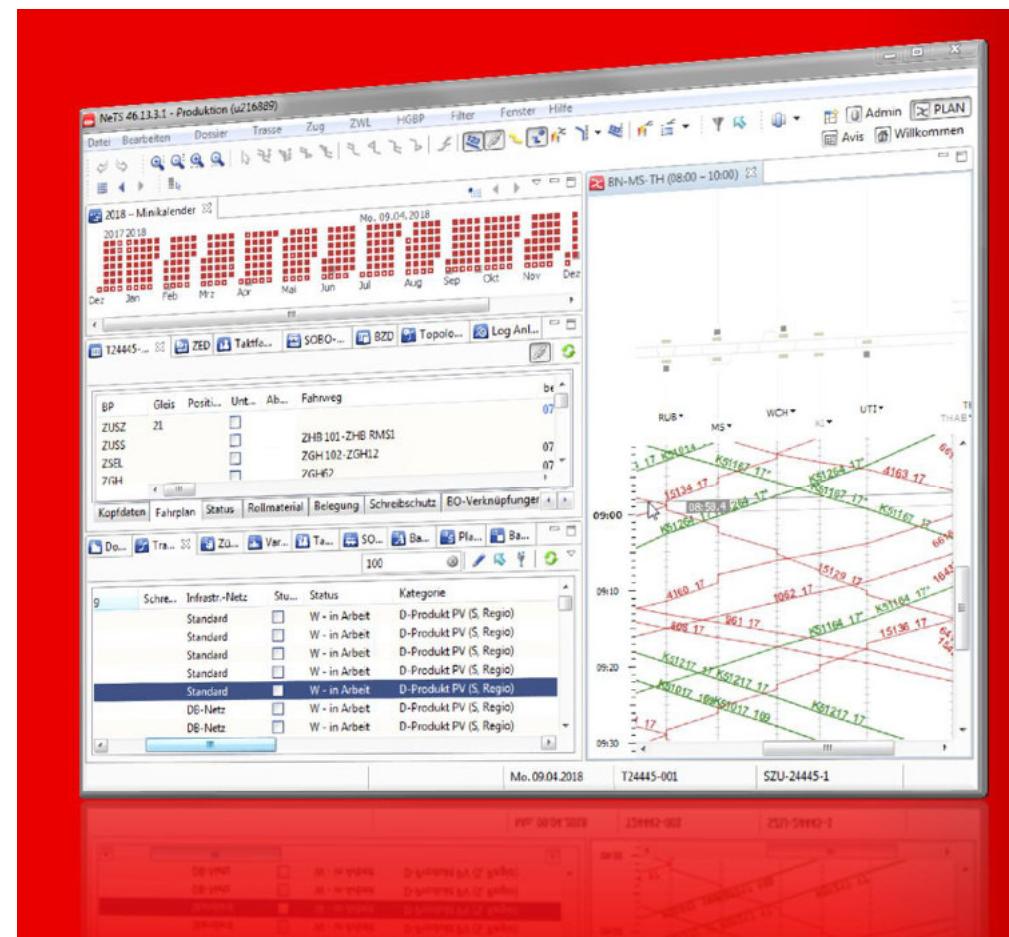


Positive experience:

Extension can be proposed and incorporated in a relatively straightforward way. Assuming the approval of the railML® community the standard can be extended within few months.

Project «PAIP» – Next Steps.

- Pursue triggered changes of railML® 2.4
- Spring 2017: Start implementation of new interface
- Certification of the application NeTS
- Continuous participation in the timetable community – even after completion of the project



Outlook regarding railML®.

- Potential format for data exchange within SmartRail 4.0
- Potential for use within asset management with version 3 and consequently at the interface between asset and traffic management
- With RailTopoModel there is a increasingly valid conceptual fundament (driven by UIC)
- Currently, there is an IT study under way within SBB regarding a semi-automated maintenance of topology data for Viriato with RailTopoModel being a candidate for the underlying topological model



Consequences Regarding RailTopoModel.

- Consider and incorporate necessary extensions in the conceptual model (RTM) with the goal of accomplishing a homogenous time management in the areas of timetable and infrastructure
→ One (and only one) time dimension approach!
- Coordination and collaboration between RTM Expert Group and railML® timetable community needs to be intensified (mutual information about and review of current work).





SBB CFF FFS

Any questions?

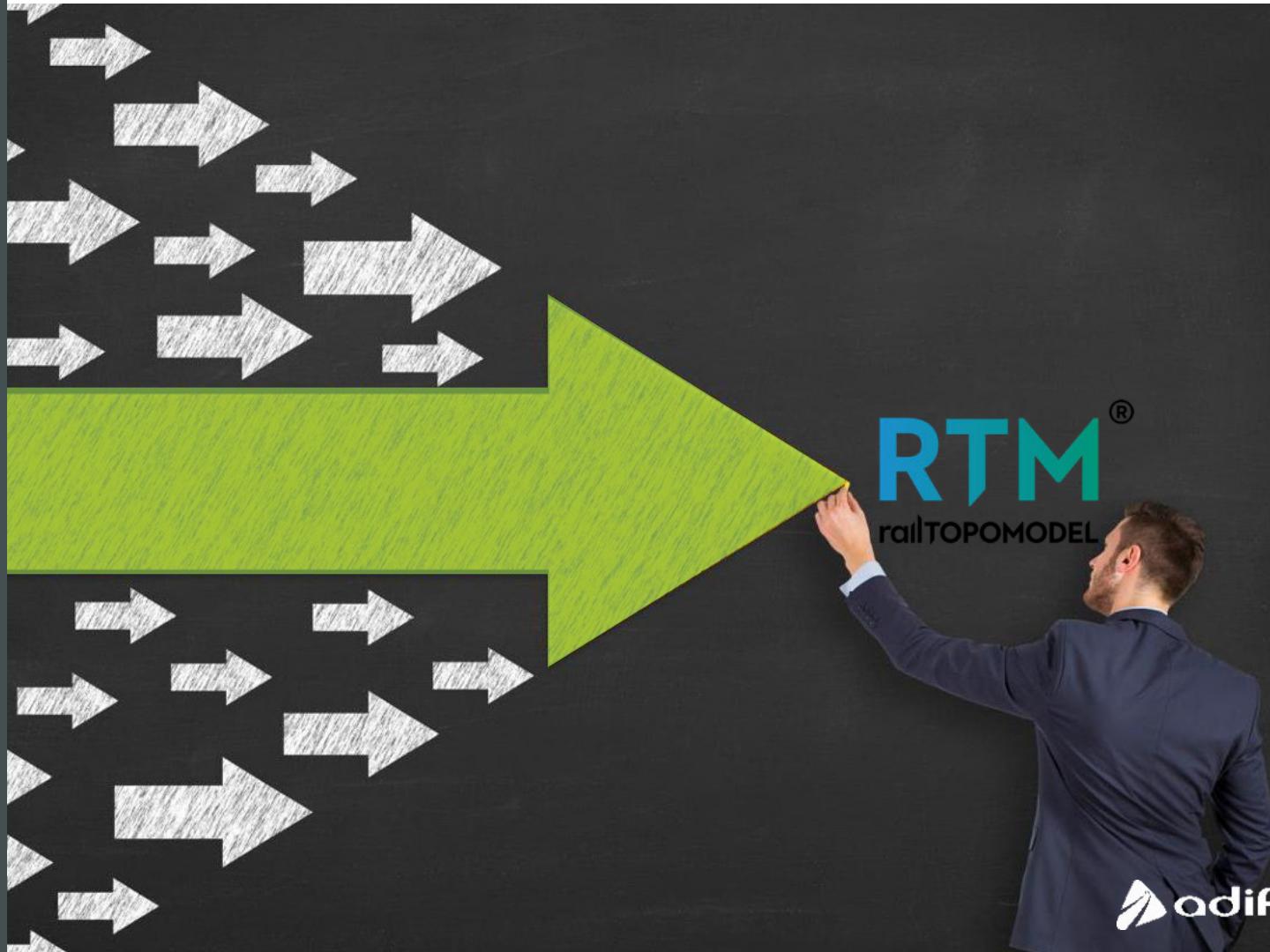
Schweizerische
Bundesbahnen SBB

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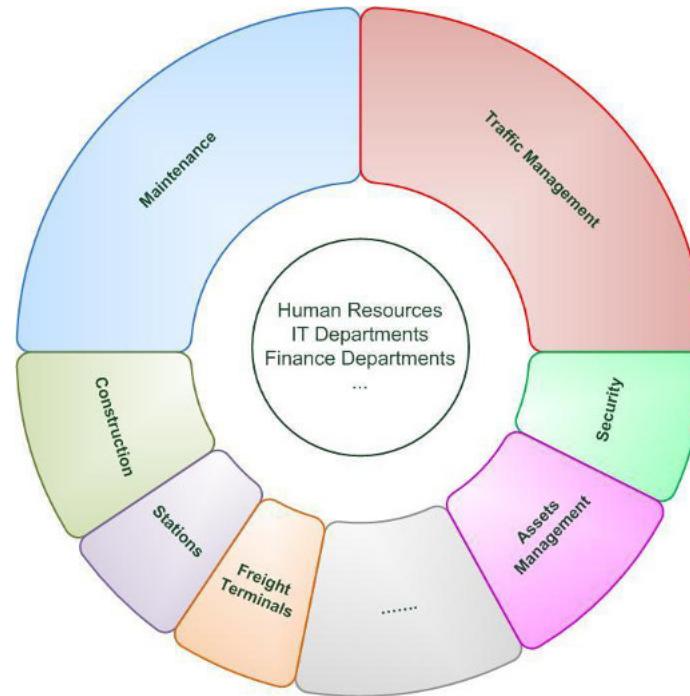
Steps towards implementing RailTopoModel in ADIF



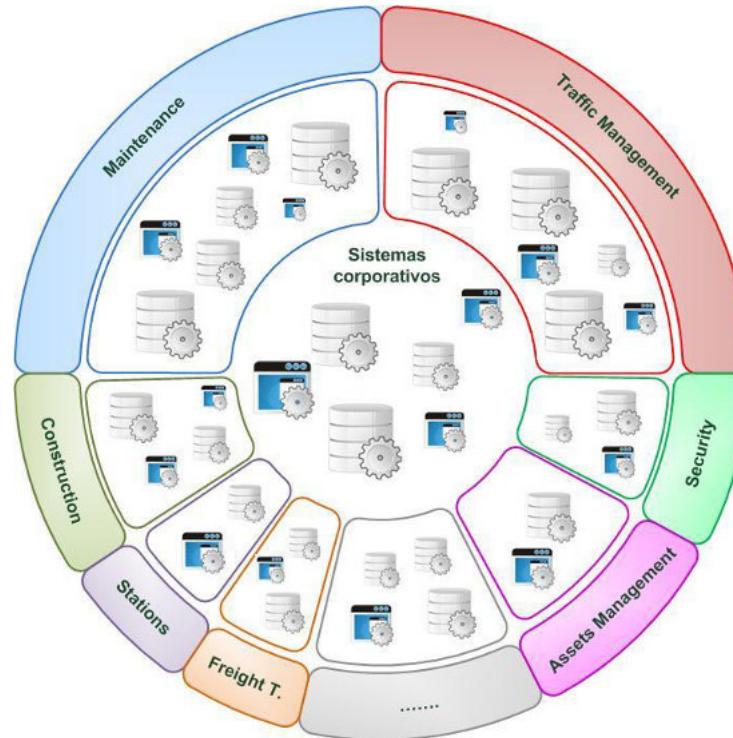
ABOUT ADIF...

- In 2005 there was a change in the Spanish Railway industry:
RENFE (1941) and **GIF** (1998) splitted into:
 - **RENFE Operator:** Owner of trains and responsible for its circulation, working in competition with other railway companies.
 - **ADIF:** Owner of the railway infrastructures (tracks, stations, freight terminals) and responsible for its maintenance, the traffic management, the allocation of the capacity of railway operators...

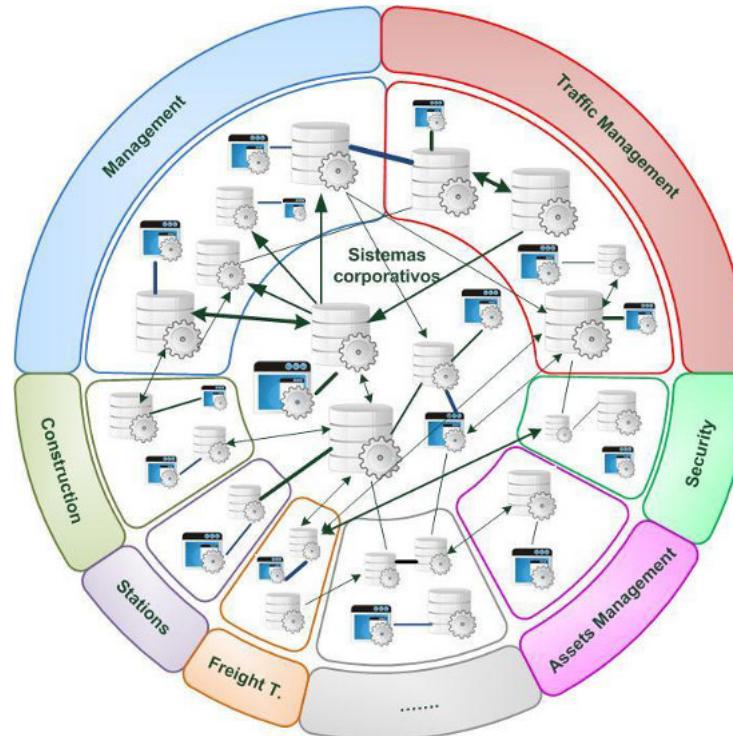
UNDERSTANDING IT SYSTEMS IN IM'S



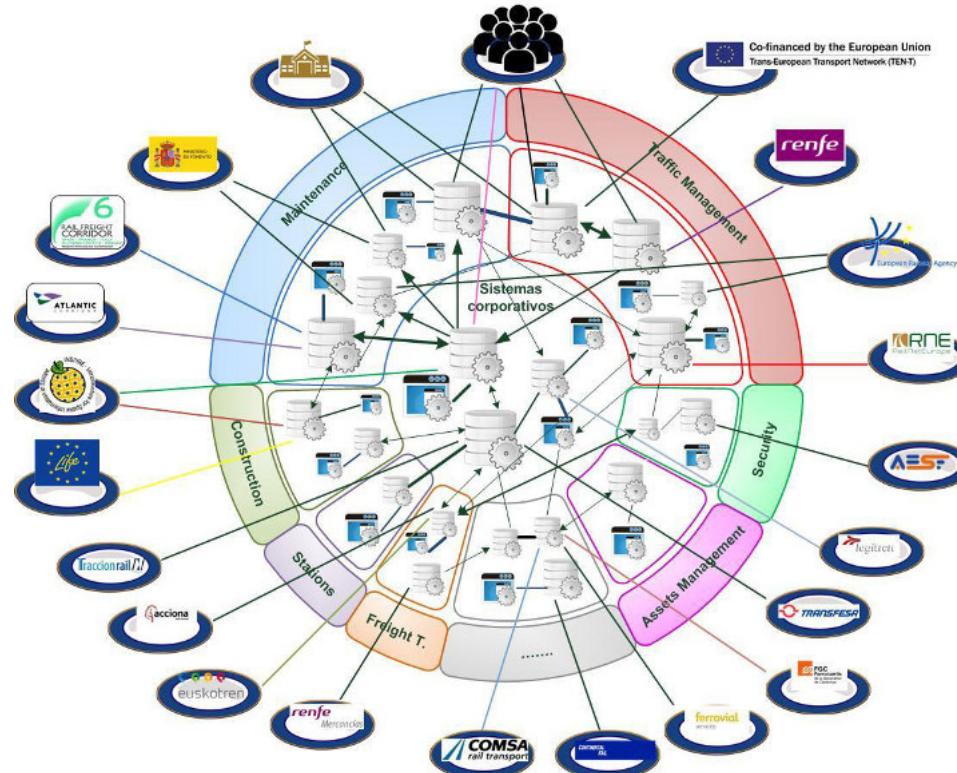
UNDERSTANDING IT SYSTEMS IN IM'S



UNDERSTANDING IT SYSTEMS IN IM'S



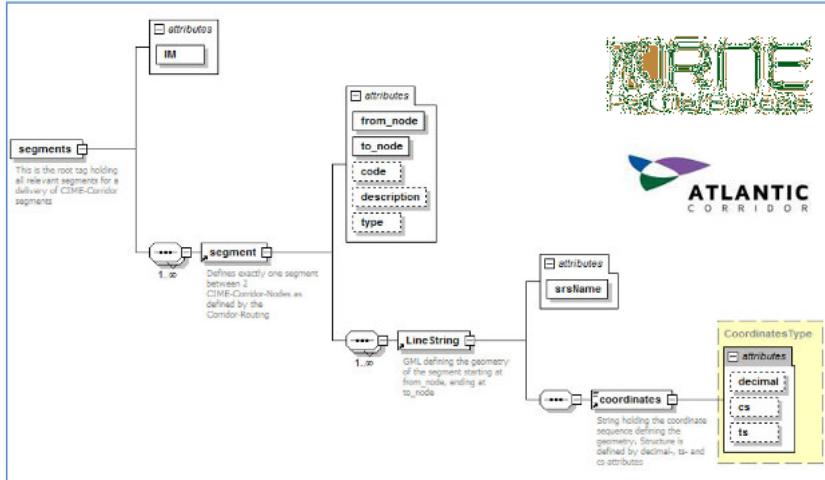
UNDERSTANDING IT SYSTEMS IN IM'S



UNDERSTANDING IT SYSTEMS IN IM'S



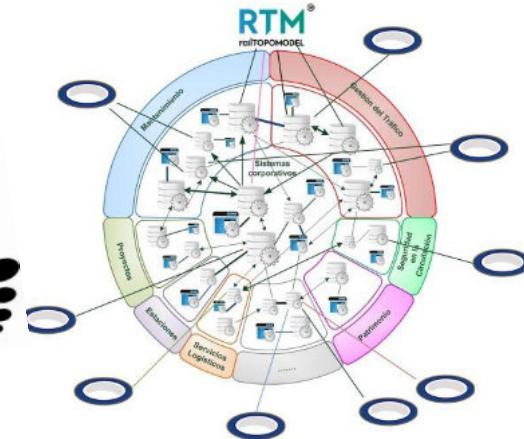
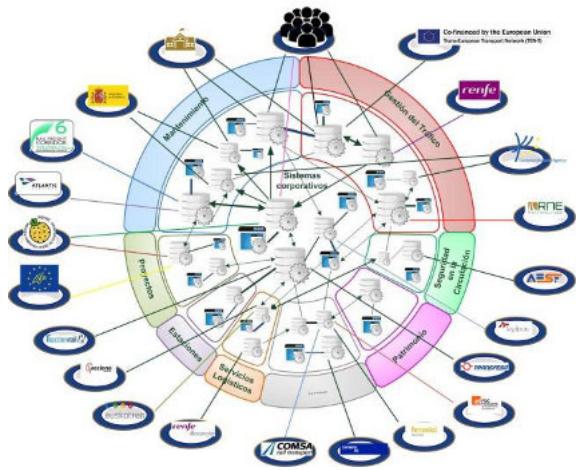
Railnet Europe – CIP Platform



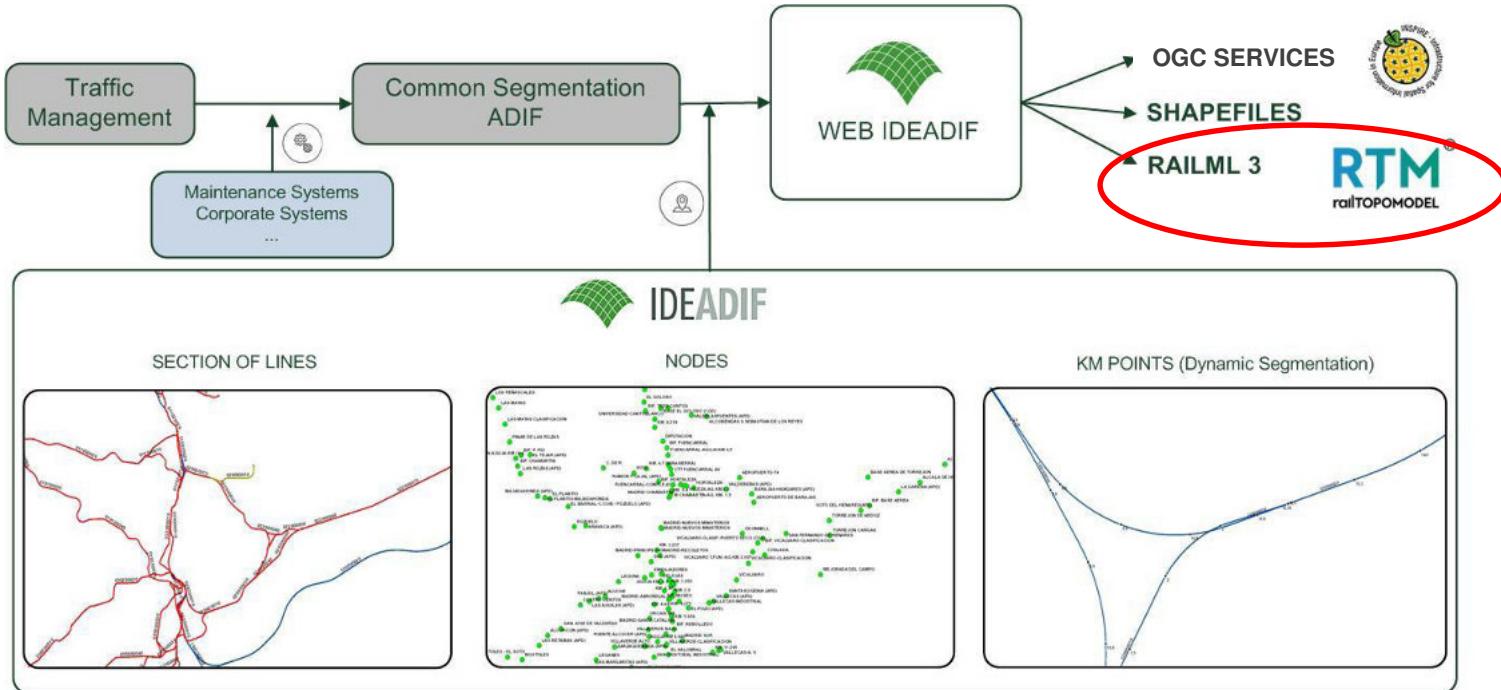
TASKS:

- Analyze the proposed model
- Mapping internal entities to the proposed model (equivalences)
- Develop the software to ensure the maintenance of the output.
- Maintain any changes in Schema Definition (both in source or destiny)

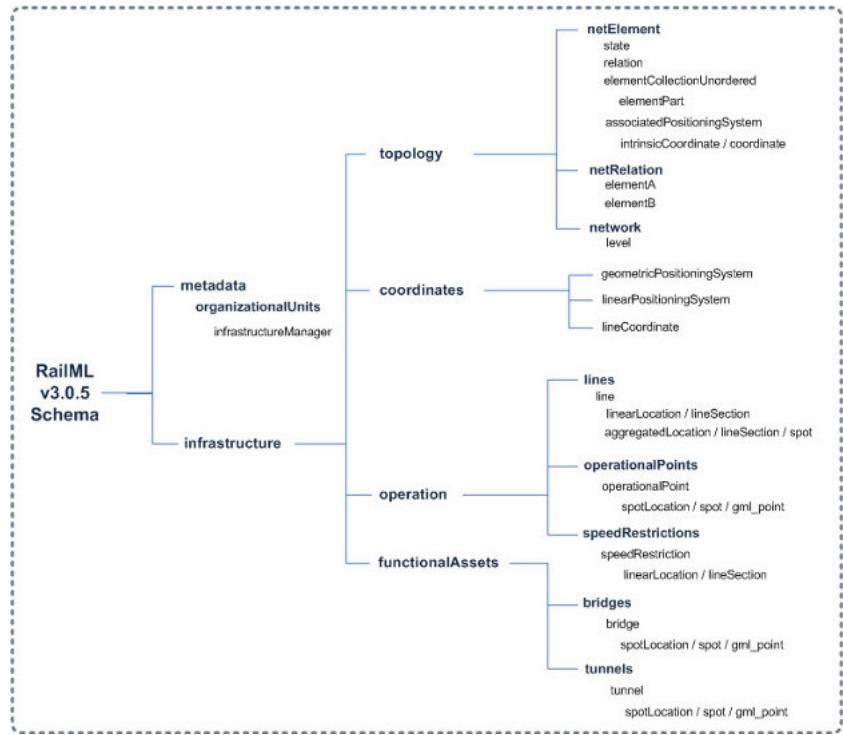
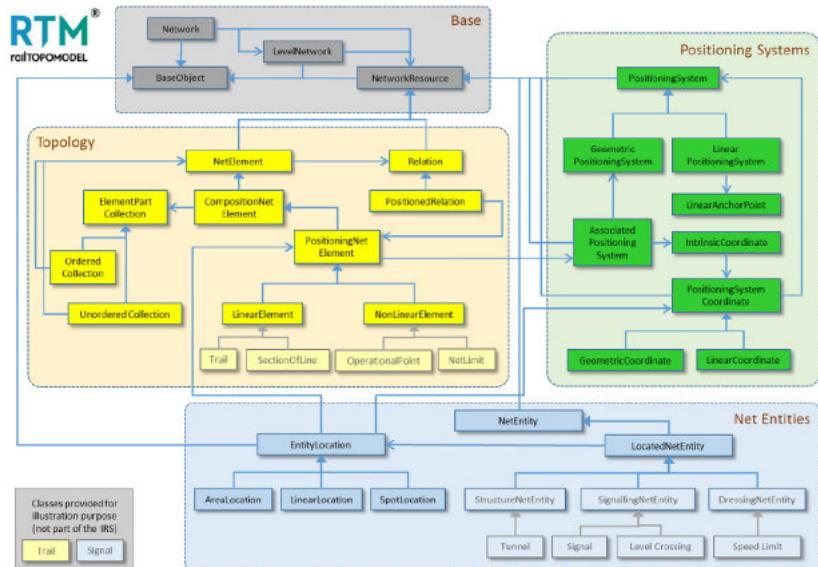
1 WHAT IS THE GOAL?



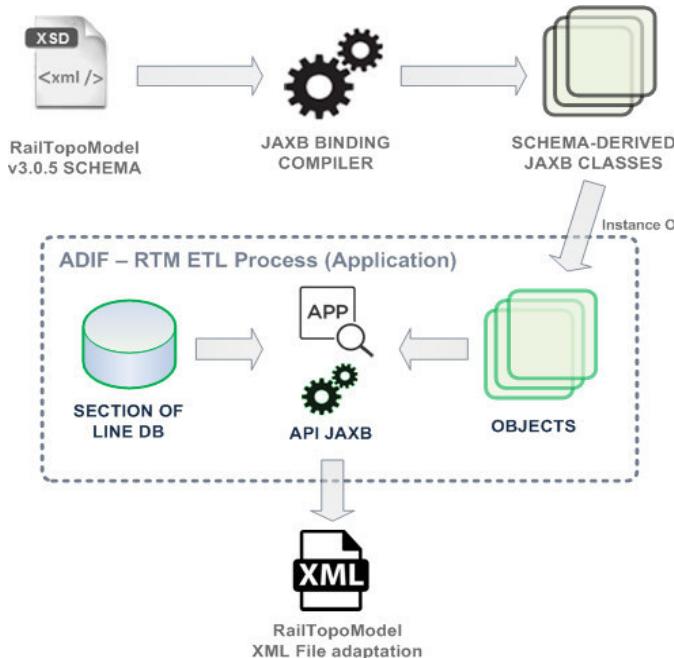
HOW IS OUR INTERNAL PROCESS?



Generating the railML file (MACRO)



Publishing the railml file in <http://ideadif.adif.es>



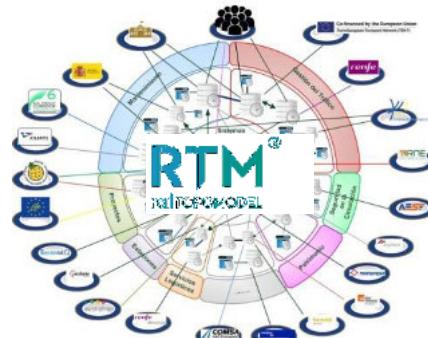
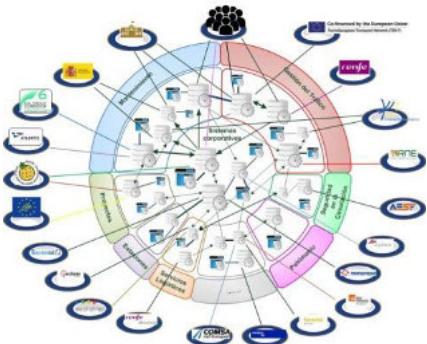
The screenshot shows the IDEADIF Access Portal homepage:

- Access Portal to the Adif Spatial Data Infrastructure**
- HOME / NEWS / CATALOGUE / COMMON SEGMENTATION / DIRECTIVES+ / EXAMPLES+**
- IDEADIF** logo
- IDEADIF NEWS** banner: "New versions available for Adif Common Segmentation and adaptation to INSPIRE regulations." with a "Find out more >" button.
- Service catalogue**: "Information and downloadable content for geographical resources through metadata records, data sets and services using different search criteria (spatial, thematic, etc.). Based on OGC CSW protocol for requests." with a "View details >" button.
- Common Segmentation**: "Information and downloadable content for Adif Common Segmentation, basic criteria for segmentation and identification of the dependencies of the General Interest Railway Network." with a "View details >" button.
- Integration with European directives**: "Information and downloadable content on the adaptation of Common Segmentation to Inspire." with a "View Inspire >" button.

Next steps in ADIF...

- Obtain the railml 3 certification.
- Publish railml file with infrastructure information of the network.
- Broaden the output file with more entities.
 - Covering meso and micro levels.
 - Not only infrastructure subschema.
- Support new UIC projects (RTM-BIM, RTM-GIS, RTM-SIM)

CONCLUSIONS...



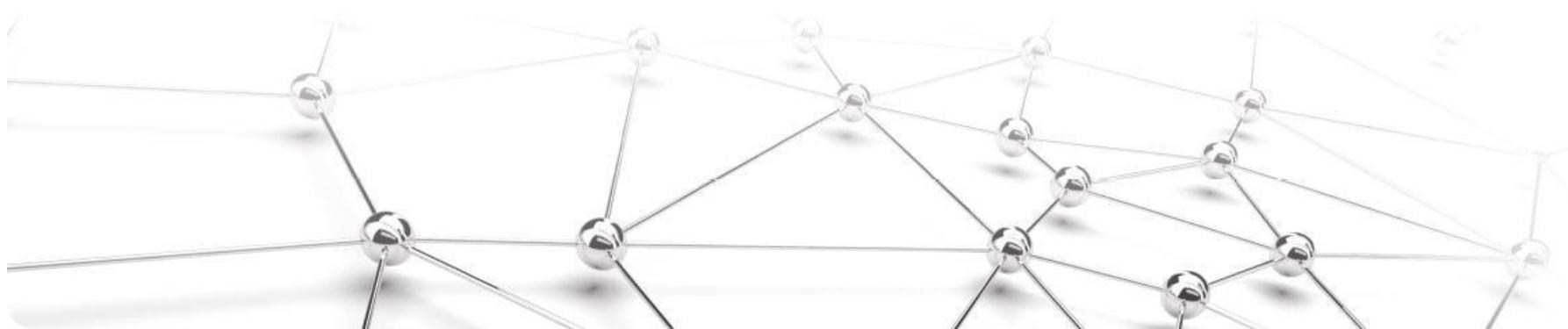


STRATEGY
AND TRANSFORMATION





Gi Smartware





Topic:

RTM[®]
railTOPOMODEL

Implementation:
An IT solution provider's perspective

Date:

19 april 2016

Introduction

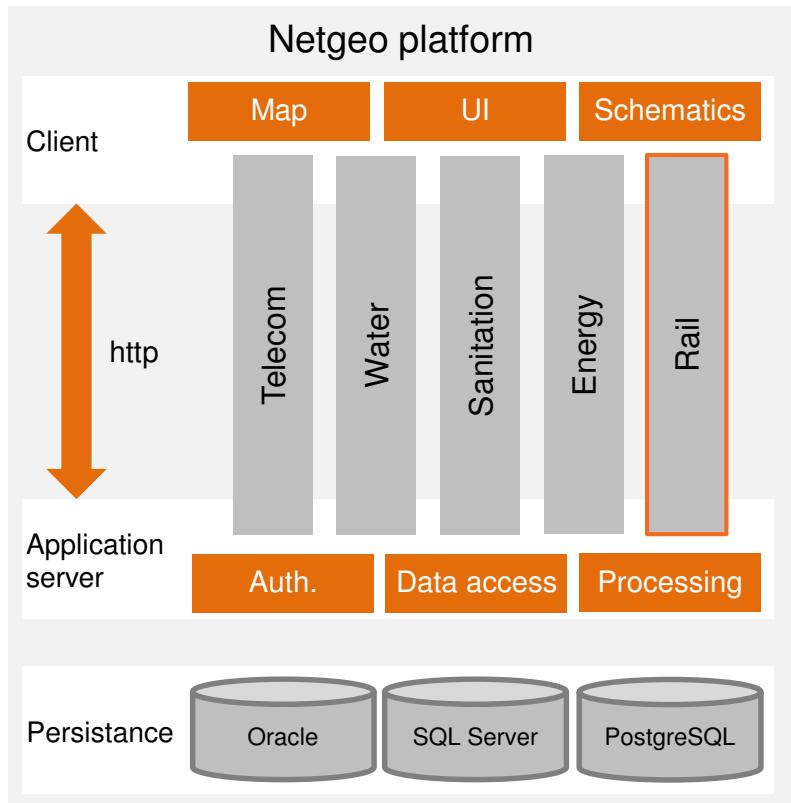
GiSmartware

► GiSmartware:

- French company
- 25 year old, 40 employees
- Software editor

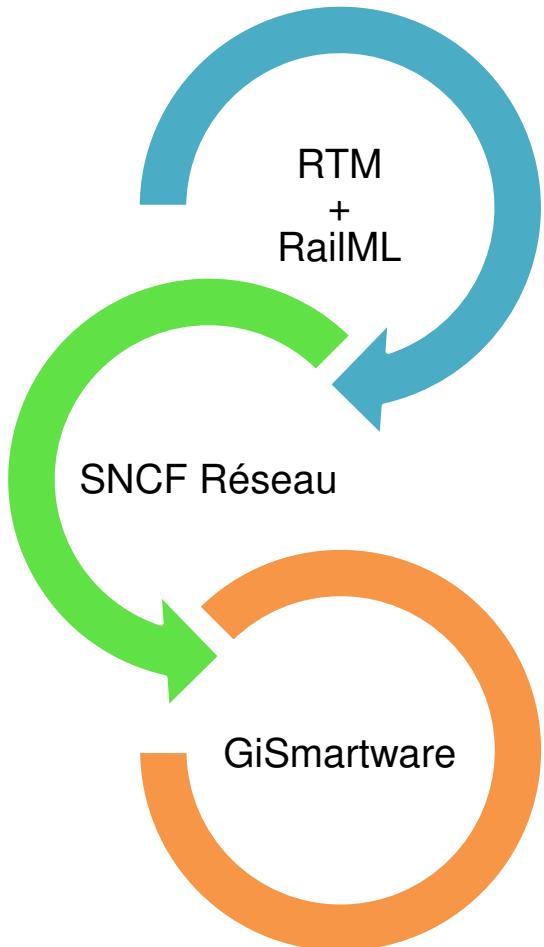
► Netgeo platform:

- SOA
- GIS for territorial network managers:
 - ✓ Telecom
 - ✓ Water
 - ✓ Sanitation
 - ✓ Power distribution
 - ✓ Railway



Netgeo Rail

Built on solid basis



► RTM: foundation

- Strong topological model
- Standardised by the UIC
- Well-documented

► SNCF Réseau: experience

- Deep industrial knowledge
- RTM-compatible Ariane model
- SOA Repository Gaia

► GiSmartware: architecture

- 25-year experience in software development
- Robust Netgeo platform
- Industrialisation know-how

Advantages of RailTopoModel

1/3 – An industrial standard

► Securing GiSmartware's investment in Netgeo Rail:

- A software designed with the business knowledge of SNCF Réseau, built to fit new customers
- Netgeo Rail is compatible with any RTM-compliant model

► Securing IM's investment in information systems:

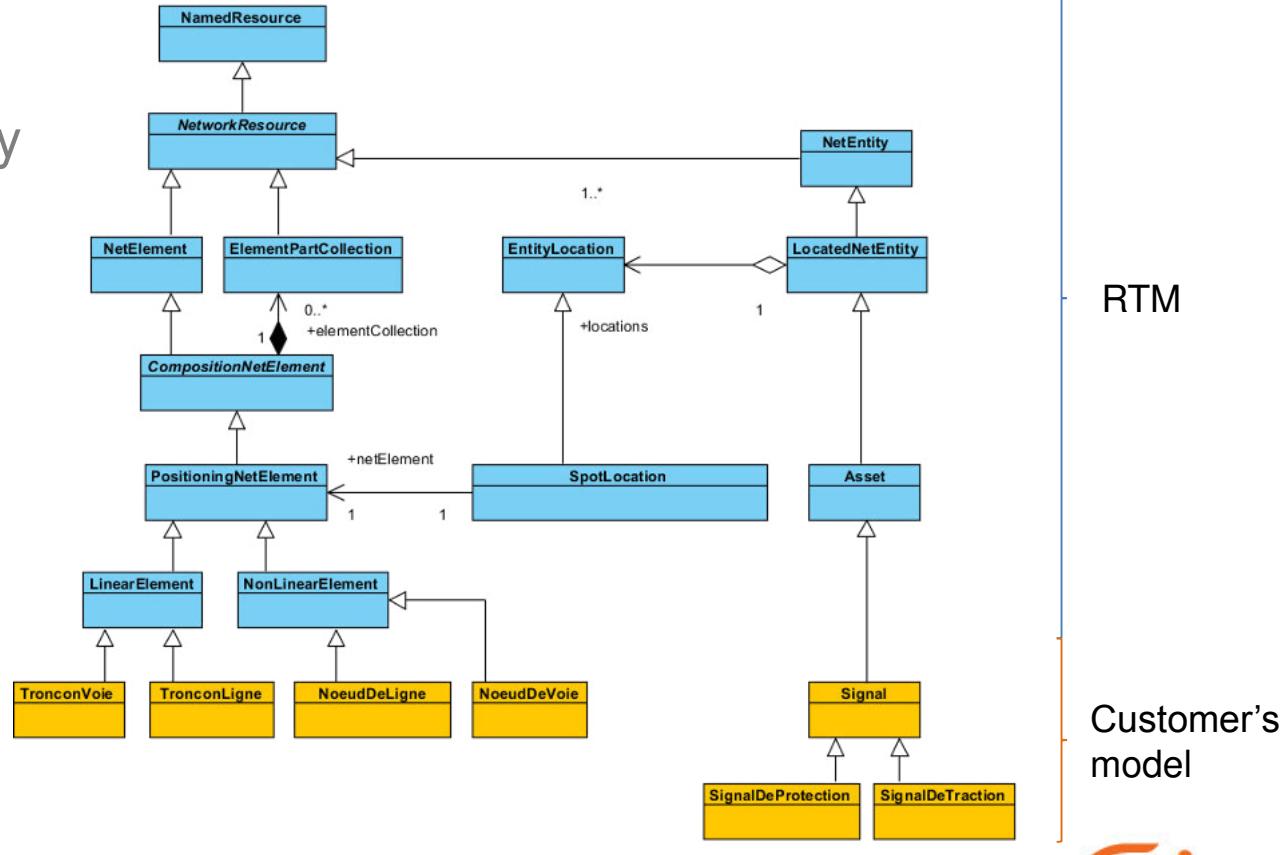
- RTM reduces the cost of entry for software vendors
- RTM roadmap secures evolutions
- This means more choice and better software for IM

Advantages of RailTopoModel

2/3 – An object model

► Object model:

- Sound basis for any software
- Easy to extend to cater to end-customer's specificities
- Guarantee for data quality



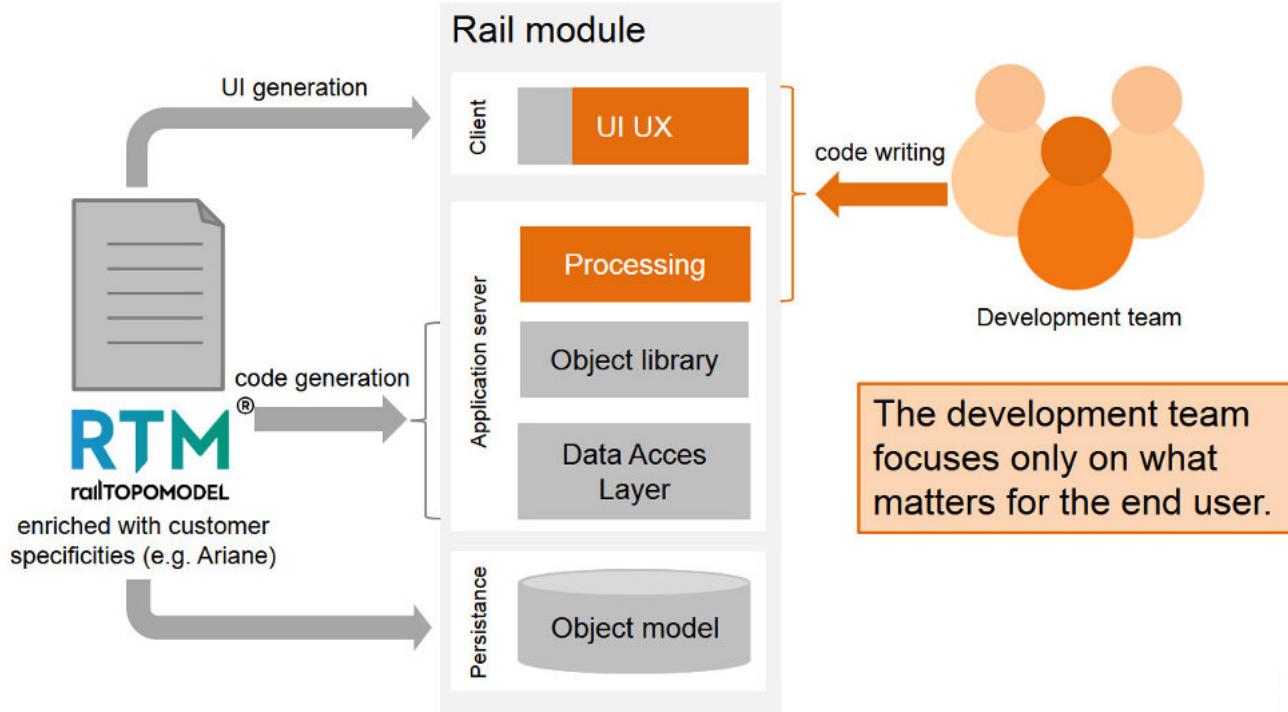
Advantages of RailTopoModel

3/3 – Well documented

- A UML model,
as an XMI file:

- Enables efficient
tooling (code or UI
generation)
- Guarantees data
well-formedness,
throughout the
system

- An unambiguous
serialisation (RailML,
for data exchange)



RailTopoModel

Our wishlist

► A UML model, as an XMI file?

- IRS 30100 available as a PDF file, the XMI file is not so readily accessible
- XMI enables powerful tooling:
 - ✓ No place for such tools to be shared (a UIC github account?)
 - ✓ Software vendors are ready

► Leveraging the knowledge of the community:

- The RailTopoModel forum is underused:
Used more for troubleshooting than sharing best practices



Gi Smartware

Event:

UIC RTM Conference

Topic:

RTM: An IT solution provider's perspective

Date:

09/05/2017

Netgeo Rail

Cartographic view: macro or micro level

Netgeo Rail Oracle MXD

Netgeo Affichage Conception Rail Habillage Add-on NetGeo

Zoom avant Zoom arrière Cadrage précédent Cadrage suivant Vue Globale Déplacement

Affichage Consultation Visibilité

Navigation

Carte Thématische

Contenu de la carte

- Rail
 - Gare
 - Ligne
- Netgeo
 - Zone Compétence
 - Plan détaillé
 - Parcelle

Actions

Actions en attente : 0

Echelle : 1 : 11 170 252 1499449,69 | 6304271,22 Mètres

Commande ▶ Déplacement Action ▶ Accrochage ▶ Système de projection ▶ RGF_1993_Lambert_93

Netgeo Rail

Description of all your infrastructure

Netgeo Rail Oracle MXD

Ligne – Ligne de Vendenheim à Wissembourg

Généralités Anomalies Actions

Identification

Nom	Id métier		
Ligne de Vendenheim à Wissembourg	471316ee-6665-11e3-afff-01f464e0362d		

Caractéristiques

Code	146000	Libellé court
Type de ligne	Ligne proprement dite	Date attribution
Réservée	Non	Depuis toujours

Système de repérage

Rang	Pk de début	Pk de fin	Pk Date de dé...	Pk Date de fin
1	0+1373	57+858	Depuis toujours	23/08/2015
1	1+147	57+858	23/08/2015	À tout jamais
2	58+672	60+026	Depuis toujours	À tout jamais

Période d'activité et métadonnées

Echelle : 1 : 11 170 252

Actions en attente : 0

Commande ▶ Déplacement Action ▶ Accrochage ▶

Modifier Actions Fermer

Système de projection ▶ RGF_1993_Lambert_93

The screenshot shows the Netgeo Rail software interface. At the top, there's a toolbar with various icons for zooming, panning, and viewing. Below the toolbar is a navigation bar with tabs for 'Netgeo', 'Affichage', 'Conception', 'Rail', 'Habillement', and 'Add-on NetGeo'. A large orange button labeled 'Déplacement' is prominent. The main area features a map of a railway network, with a specific line highlighted in yellow. To the right of the map is a detailed information panel for the 'Ligne de Vendenheim à Wissembourg'. The panel is divided into sections: 'Identification' (containing the line name and ID), 'Caractéristiques' (containing code, type, and attribution date), and 'Système de repérage' (containing a table of station coordinates and dates). At the bottom of the panel are buttons for 'Modifier', 'Actions', and 'Fermer'. The bottom left of the screen shows a legend for 'Contenu de la carte' (Rail, Gare, Ligne, Netgeo, Zone Compétence, Plan détaillé, Parcelle) and an 'Actions' section with a 'Actions en attente : 0' message. The bottom right corner features the Gi Smartware logo.

Event:

UIC RTM Conference

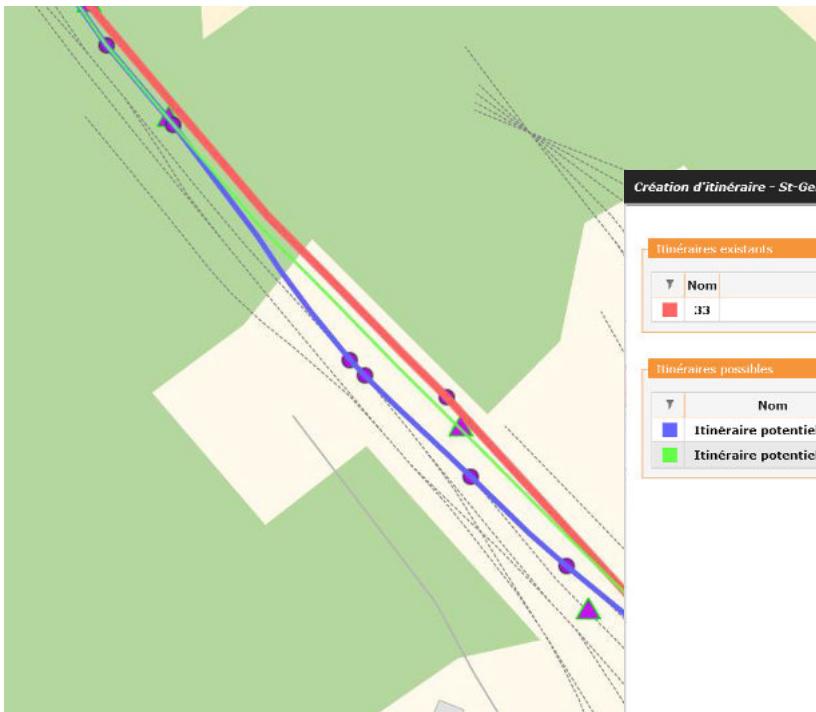
Topic:

RTM: An IT solution provider's perspective

Date:

09/05/2017

Netgeo Rail Routes



Création d'itinéraire - St-Germain-des-Fossés - Poste 1

Itinéraires existants

Nom	Appareils de voie
33	13 G - 12A D - 11B D - 9B D - 9A D - 1A G

Itinéraires possibles

Nom	Appareils de voie
Itinéraire potentiel n° 22	13 G - 12A D - 11B G - 11A G - 7 G - 3 G - 2B D - 2A D - 1B...
Itinéraire potentiel n° 23	13 G - 12A D - 11B D - 9B G - 2A G - 1B D - 1A D

Critère sur les APV

APV empruntés	APV exclus
11A	248
11B	
12A	
12B	
13	
14B	
1A	
1B	
20	
22AC/23BD	
22D	
24A/21B	
25B	
2A	
2B	
3	
32A	
7	
9A	
9B	

APV imposés

Rechercher Fermer

Netgeo Rail

Do you want to know more?

► Fabrice Simonin

- GiSmartware R&D manager
- Netgeo Rail product manager

► Contact me:

- fsimonin@gismartware.com

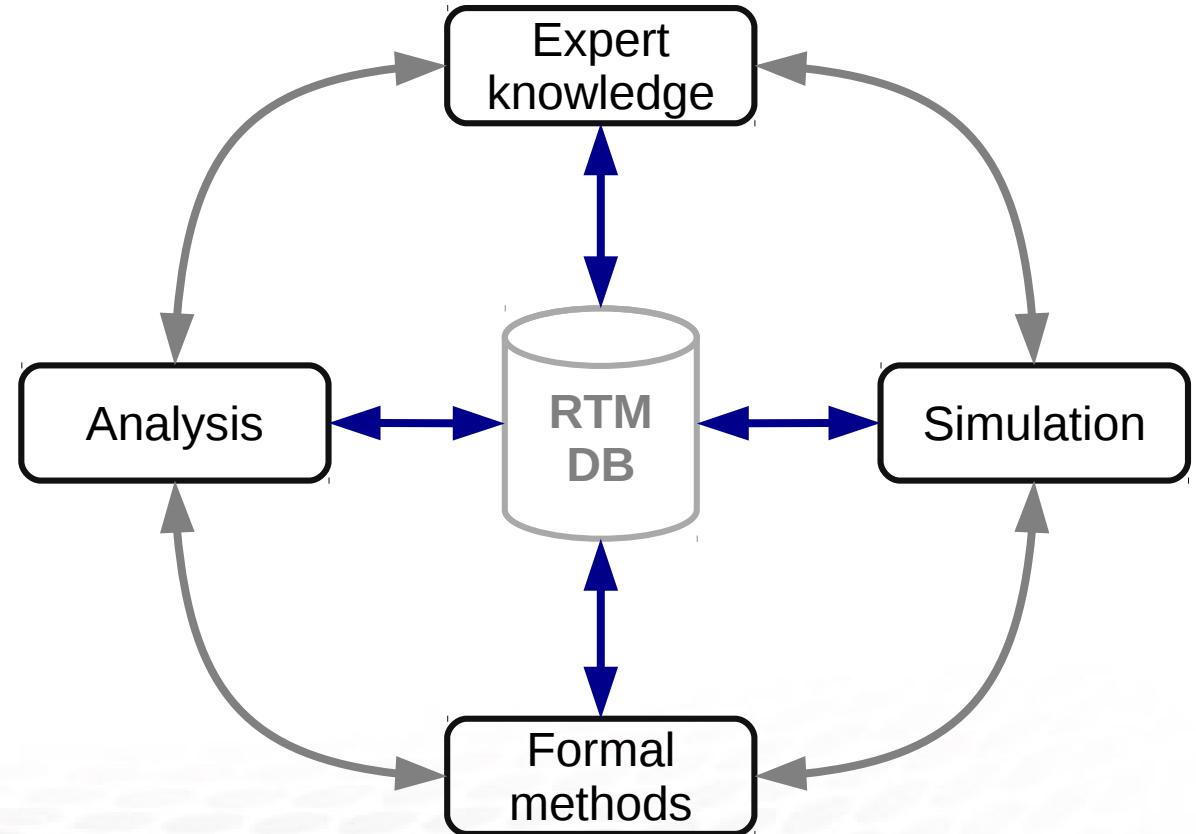


**RailTopoModel for route protection
and simulation**

Exploration work, 4th of may 2017

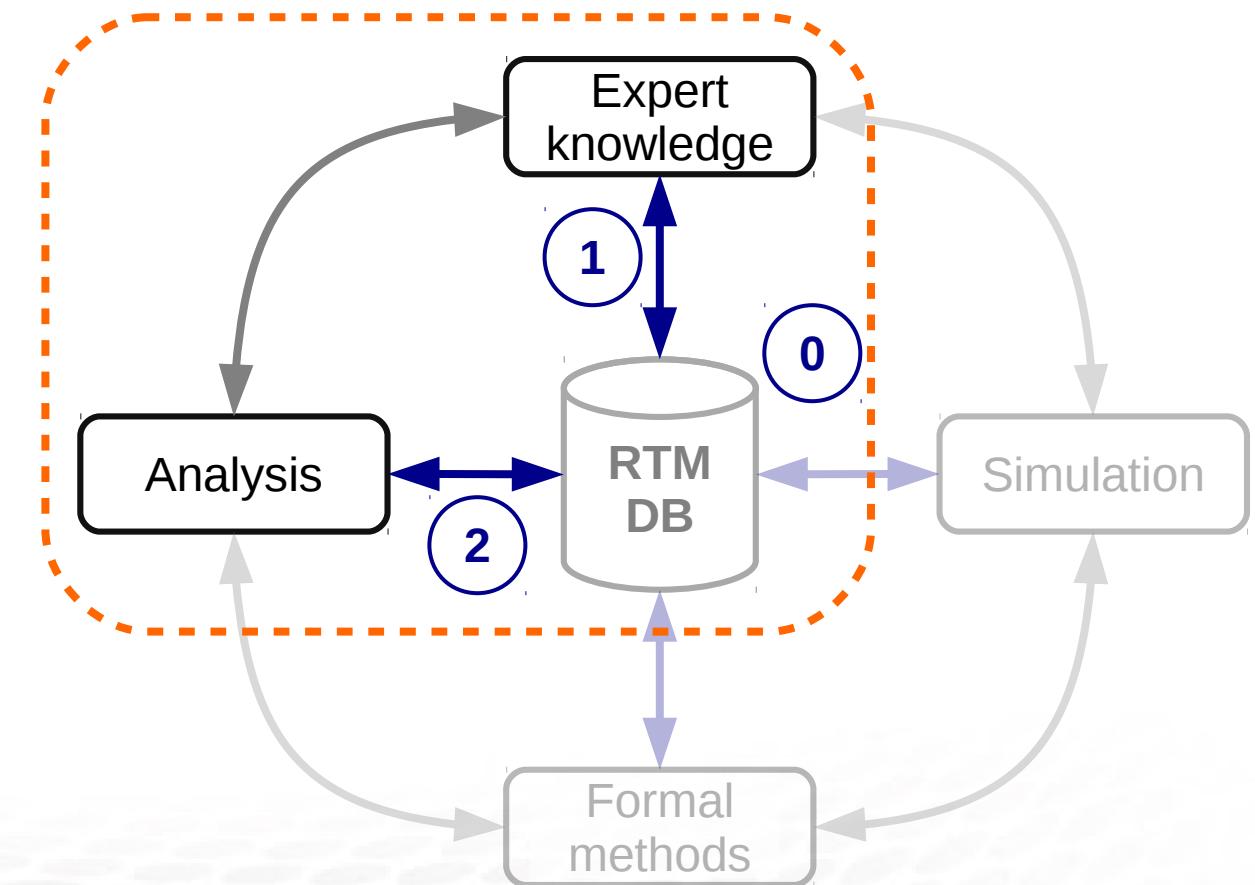
Why we use RailTopoModel

- Apply “model-driven” methodologies for railway domain
 - Infrastructure
 - Signalling
 - Ertms
- Use of computerized tools
 - Simulation
 - Formal methods



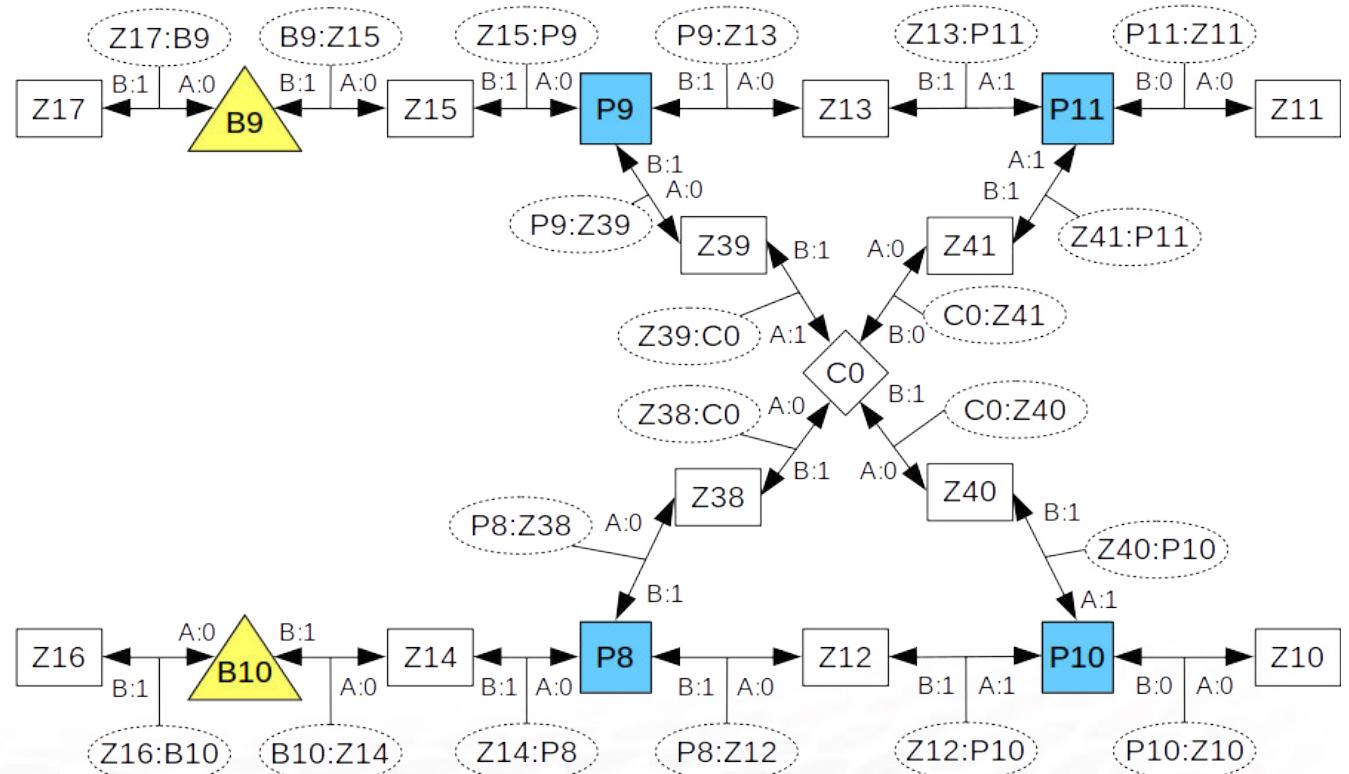
Early Works

- ① Focus on modelling of railway infrastructure
 - Infrastructure
 - Route
- ② To perform analysis
 - Route calculation
 - Train/route protection
- ③ Using a prototype RTM implementation



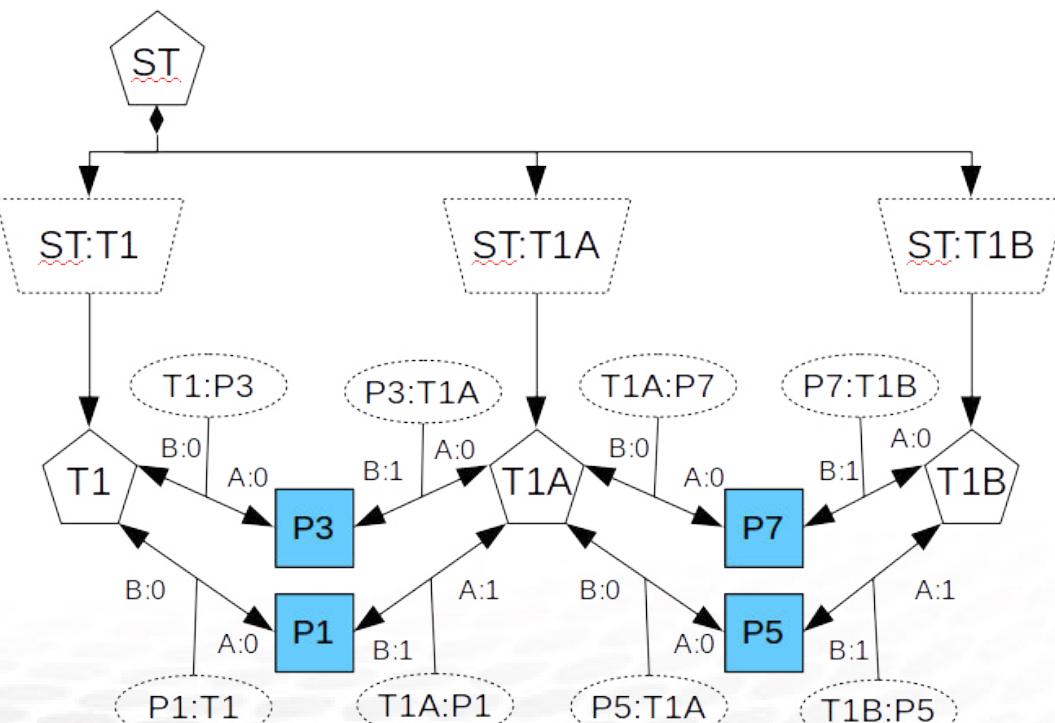
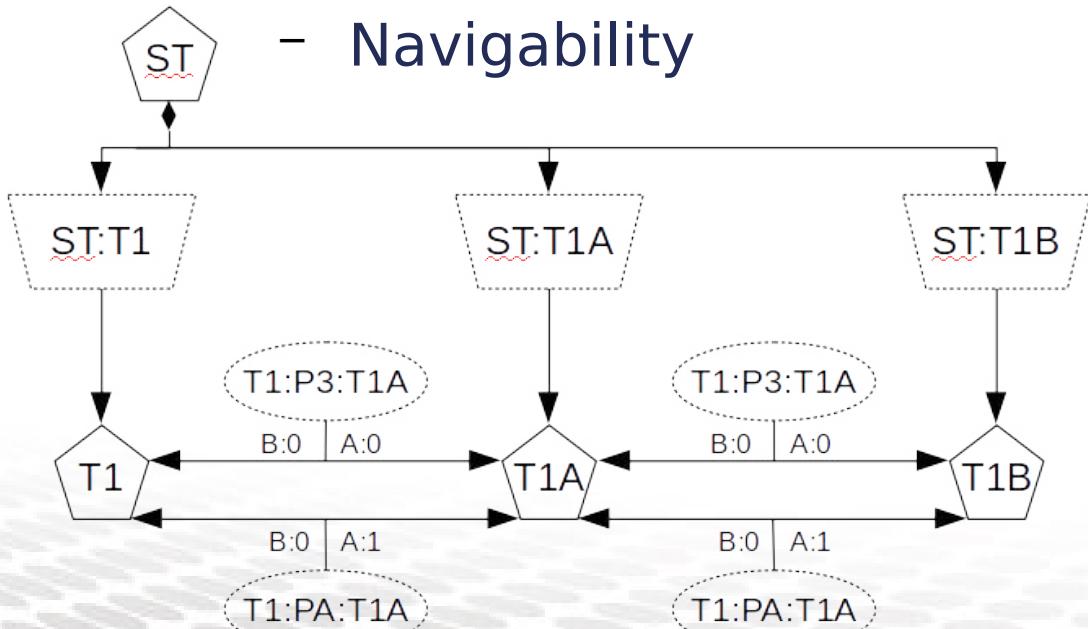
Modelling with RailTopoModel

- How to model Infrastructure ?
 - Low level modelling
 - Rules to navigate object smoothly
- How to represent RailTopoModel model ?
 - Schematic
 - Graph view



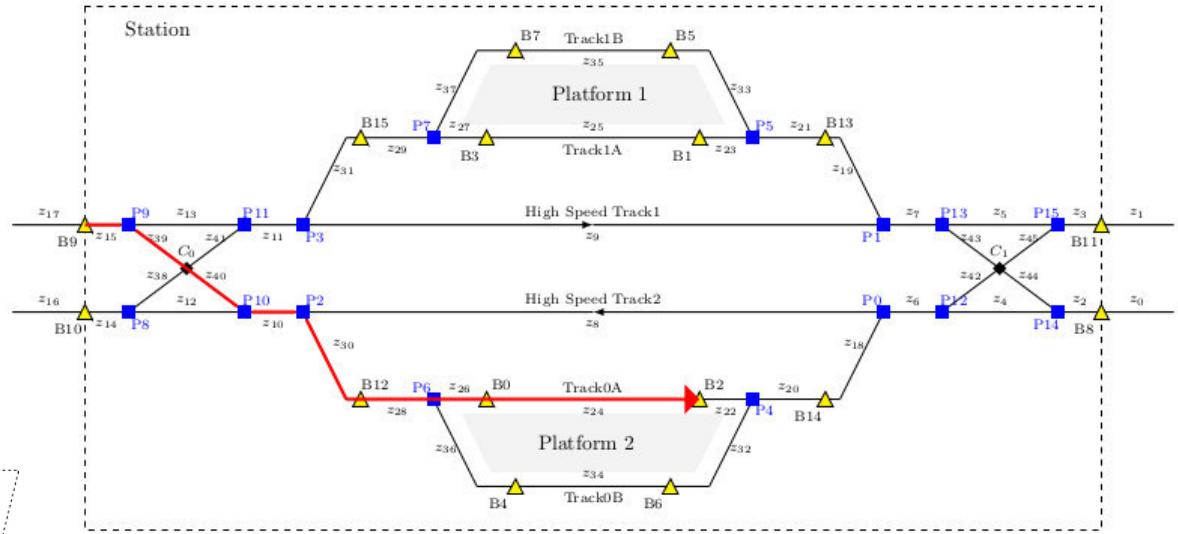
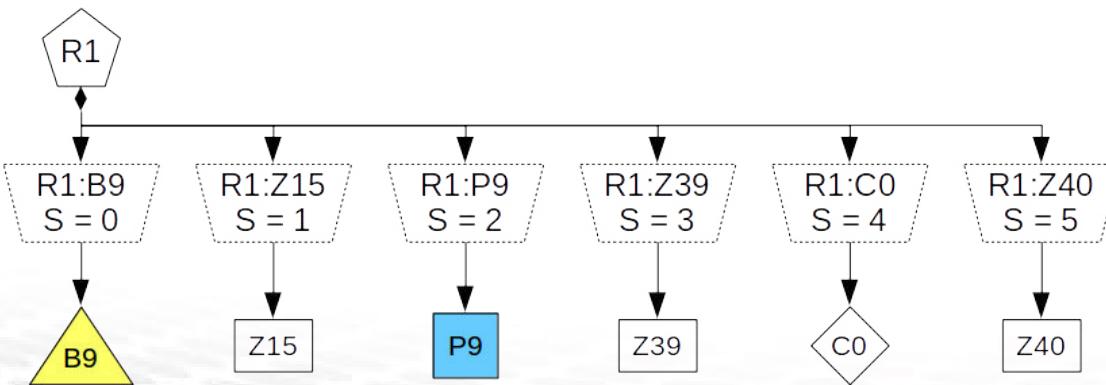
Modelling with RailTopoModel

- How to model Infrastructure to be usable with analysis tools ?
 - Level of details / Scaling
 - Navigability



Analysis based on RailTopoModel Model

- Use route model to get
 - Points to control
 - Balises messages to set

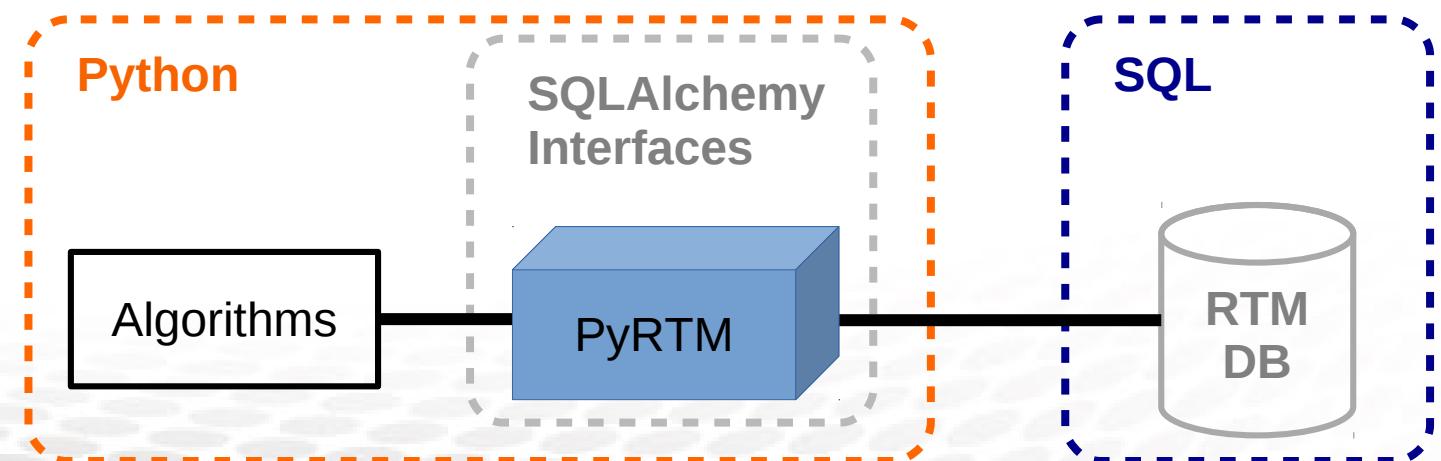


RTM implementation prototype

- Based on Python and SQLAlchemy
 - Python code easy to extend
 - SQL DB is standard for data hosting
 - PyRTM module to import
 - Still Prototype !



SQLAlchemy



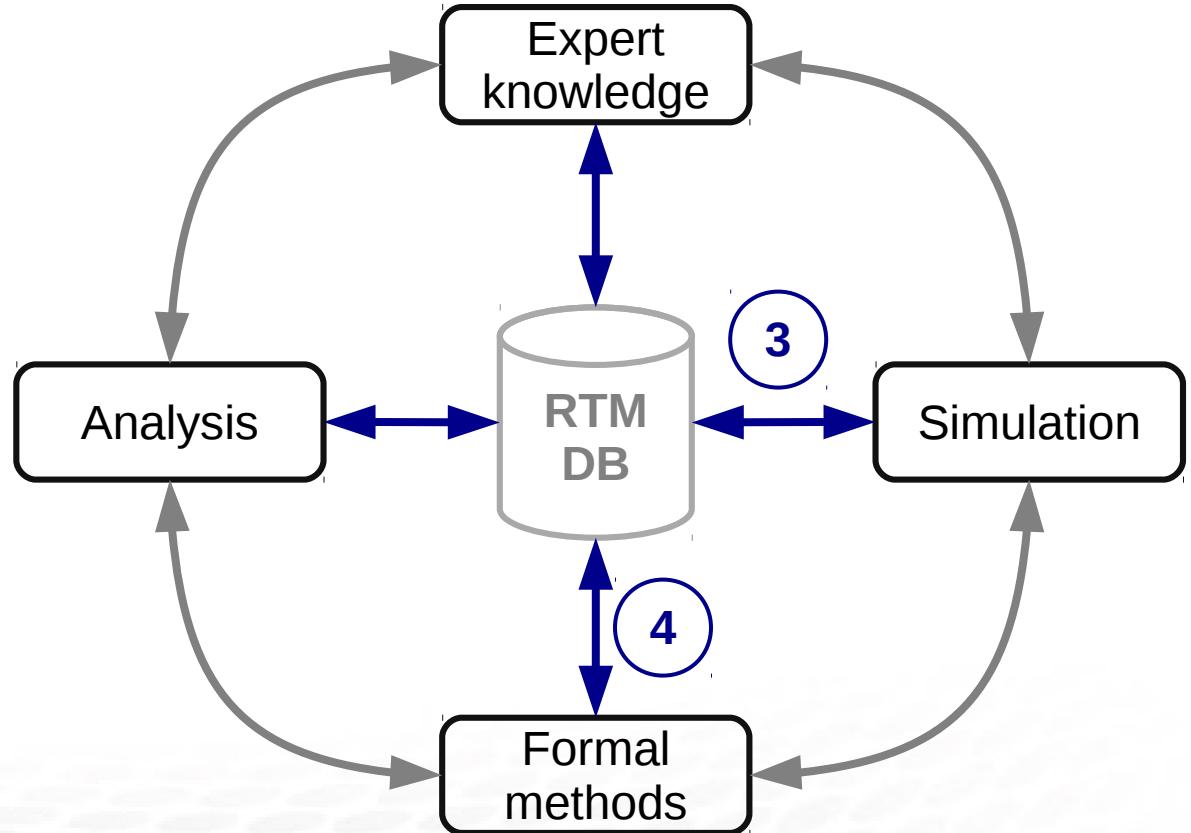
Working On

③ Link to ERSA ERTMS simulator

- Link ERTMS object to RTM
- Perform analysis on ERTMS infrastructure

④ Linked with Formal methods tools

- B method for control command
- Petri Net model for analysis





Thanks you for your attention !

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samir.assaf@raileniум.eu