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WP5 – PROCESS OPTIMISATION

Mid-term Conference, October, 5th 2018

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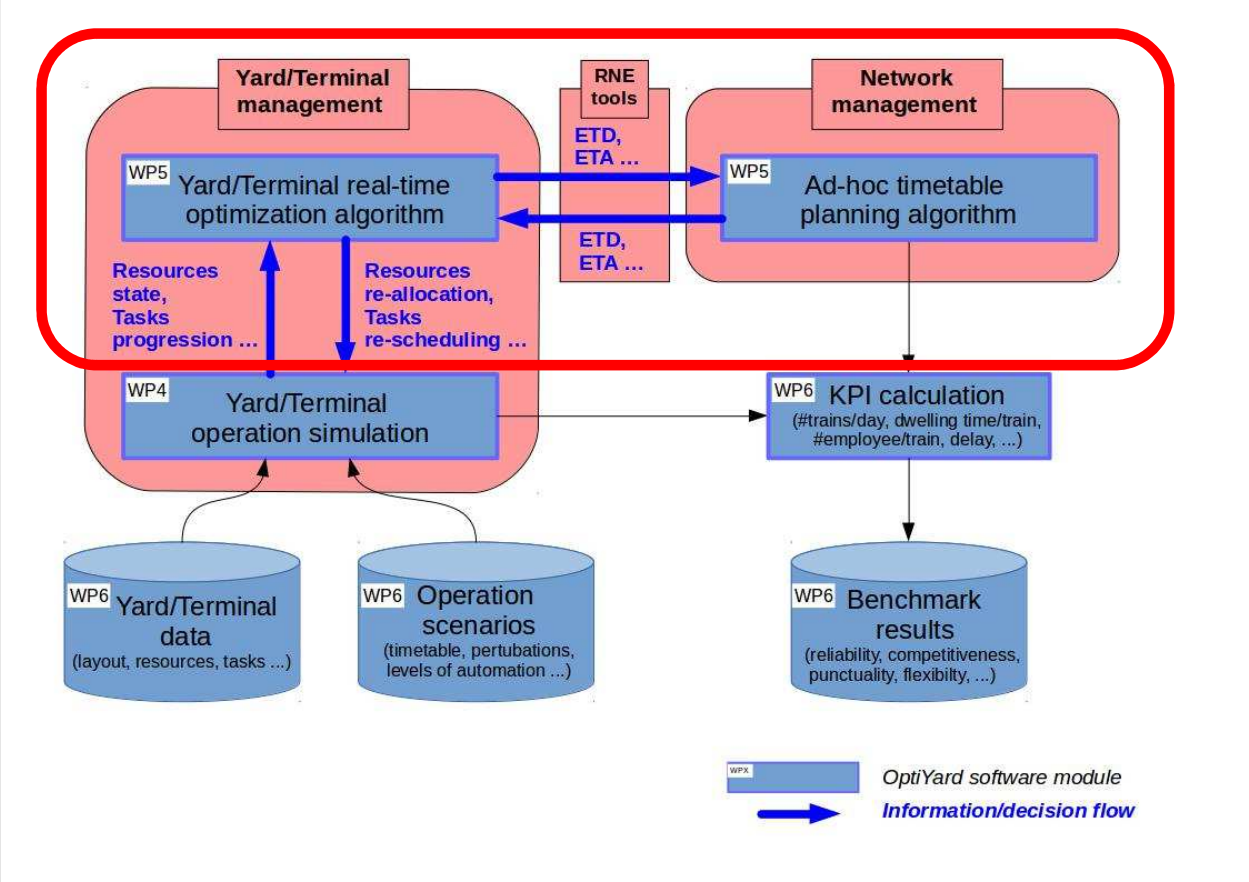
OBJECTIVES

Proposal of innovative contributions for the **yard management processes optimization** with a link to the network

Three goals:

- improvement of the **information and communication** channels between stakeholders
- design and implementation of an effective **integrated optimization and simulation framework** for real-time yard management
- proposal of an automated decision support tool for **network** management

ROLE WITHIN THE PROJECT



TASKS

The work is organized in four tasks:

1. Improved **information and communication**
2. Improved **decision support** system at the **yard** level
3. Improved **decision support** system at the **network** level
4. Definition of the **integrated framework** of optimization and simulation

T5.1 - IMPROVED INFORMATION AND COMMUNICATION

M6-M14 → March - November 2018

Lead: OG

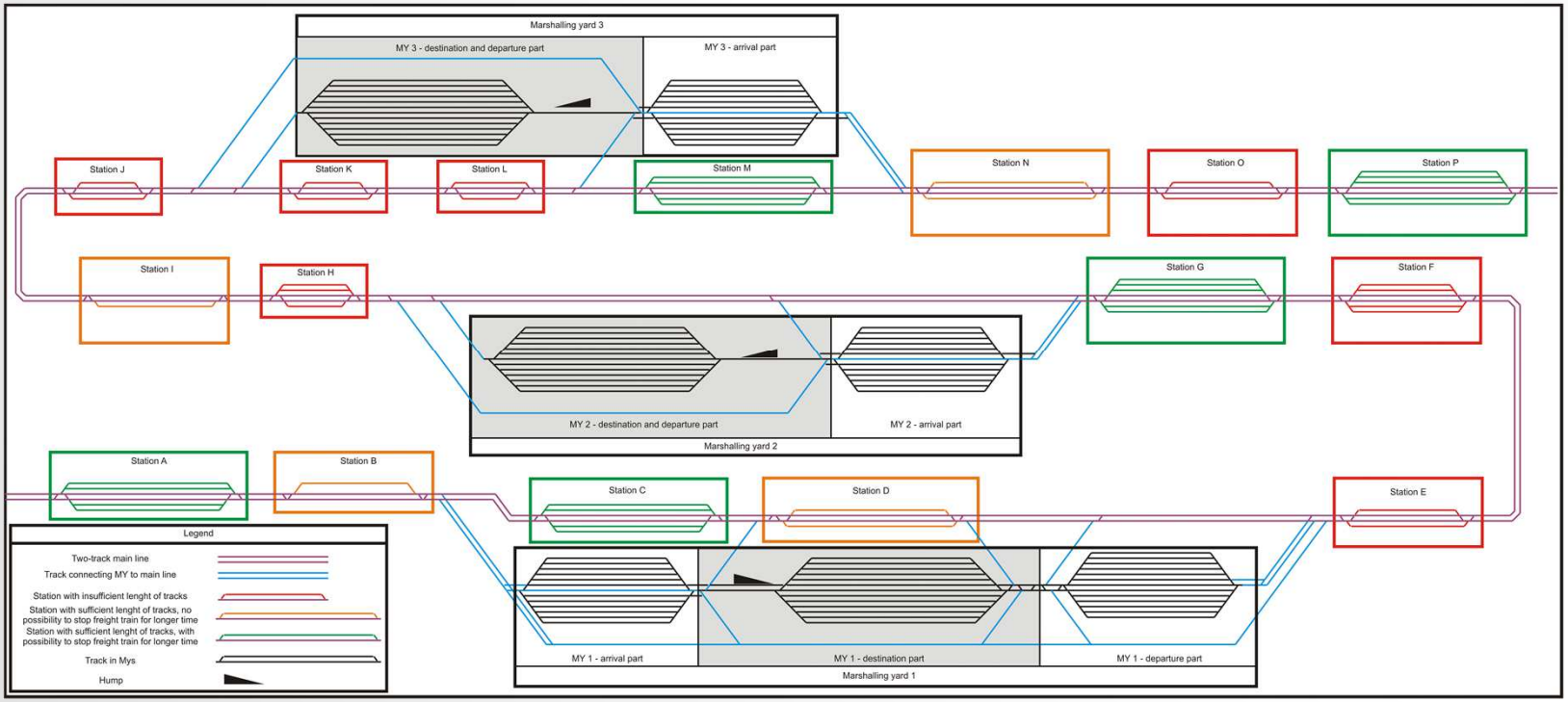
Contributors: IFSTTAR, LEEDS, SIMCON, UNEW, TUD

Focus: analysis and improvement of the existing information and communication channels

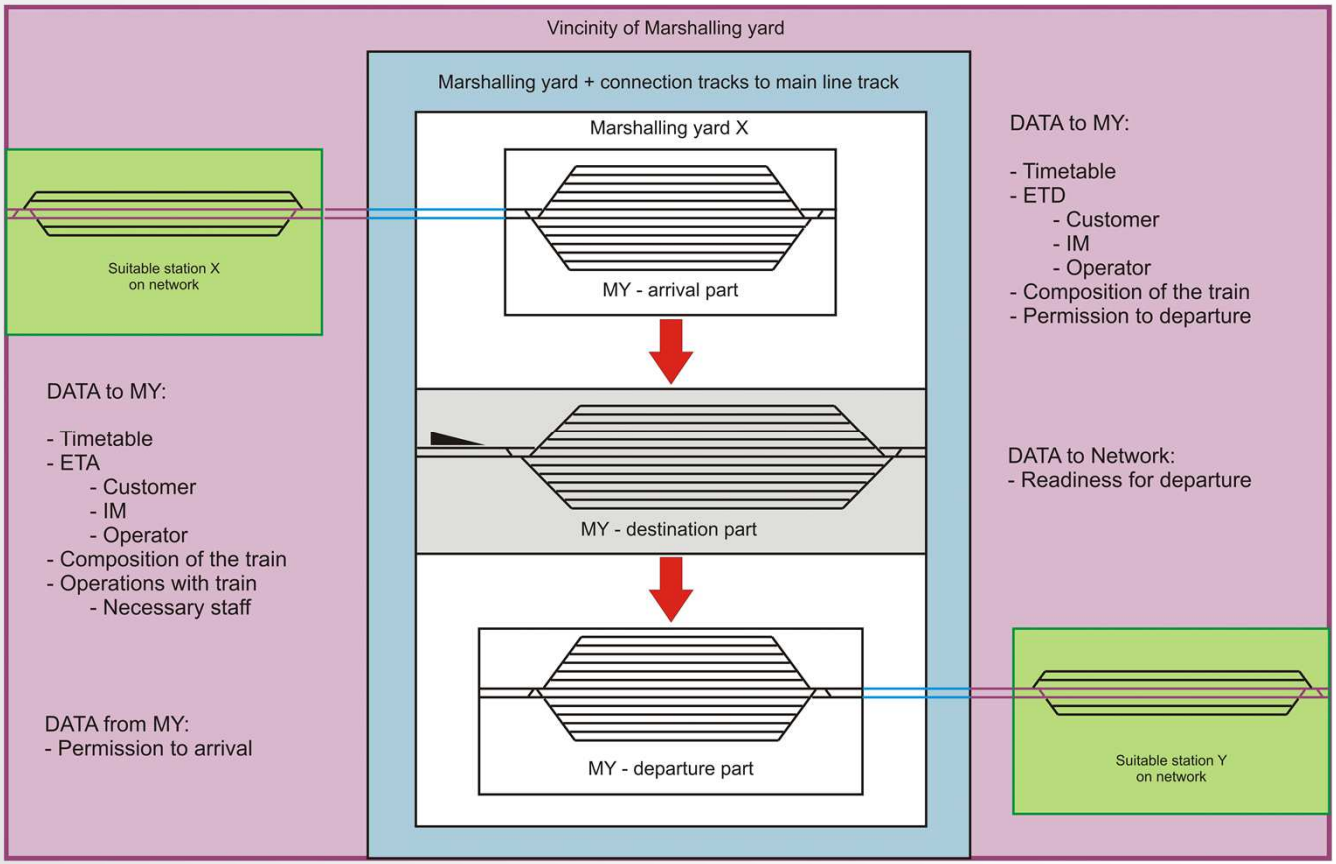
Objective: ensure the correct and timely information for the needs of the simulation and the optimization

Aimed result: a set of usable data flow schematics and a proposal of changes and extensions of information contents

T5.1 - INTERCONNECTION OF MARSHALING YARDS



T5.1 - INTERFACE

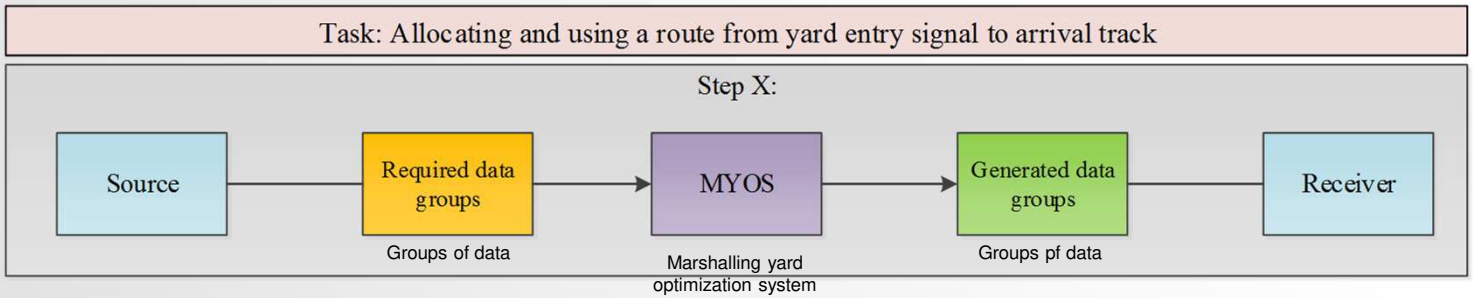


T5.1 - EXAMPLE

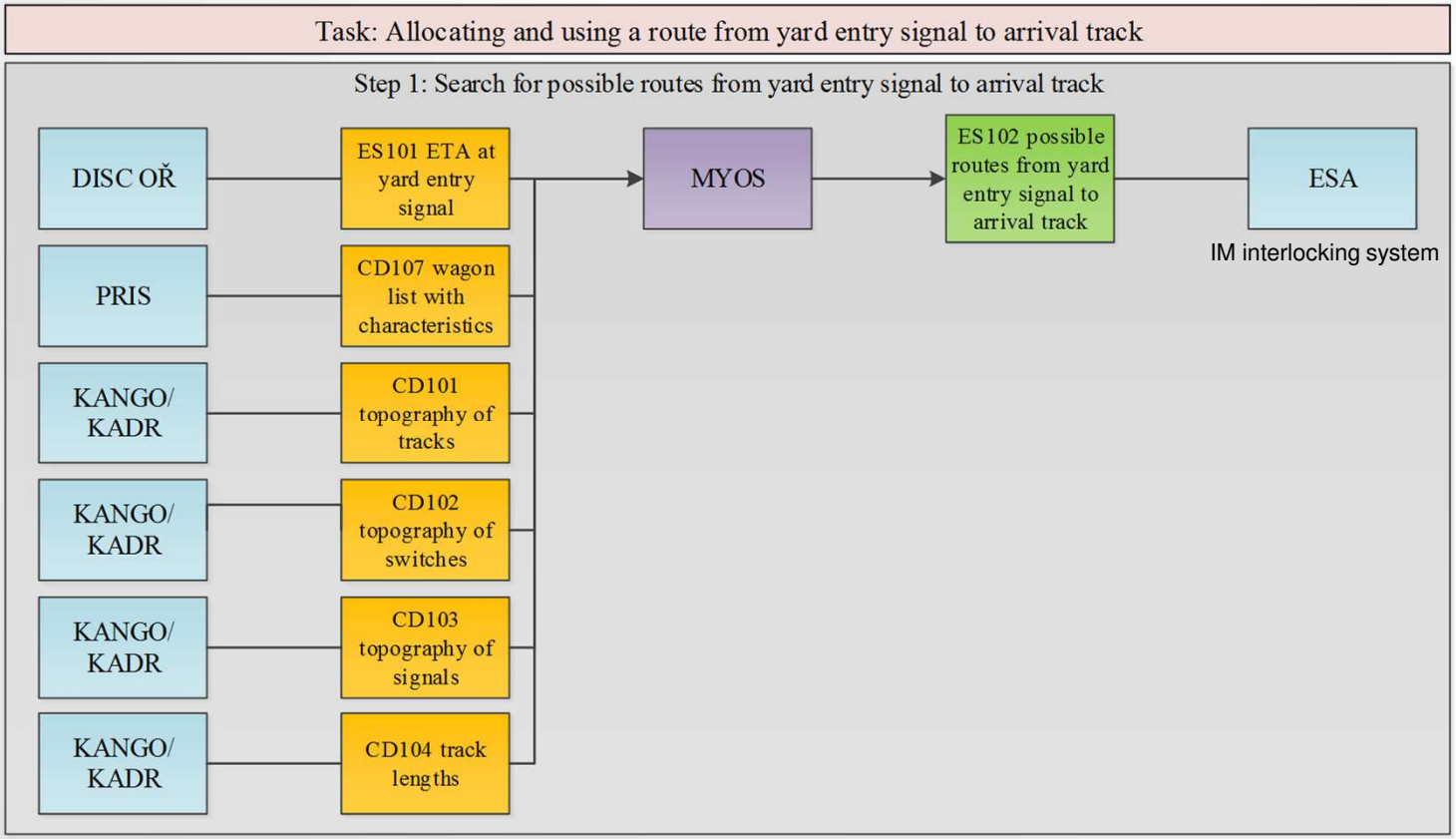
Steps of task "Allocating and using a route from yard entry signal to arrival track"

1. Search for possible routes from yard entry signal to arrival track.
2. Decision for route from yard entry signal to arrival track.
3. Locking route from yard entry signal to arrival track.
4. Moving train from yard entry signal to arrival track.

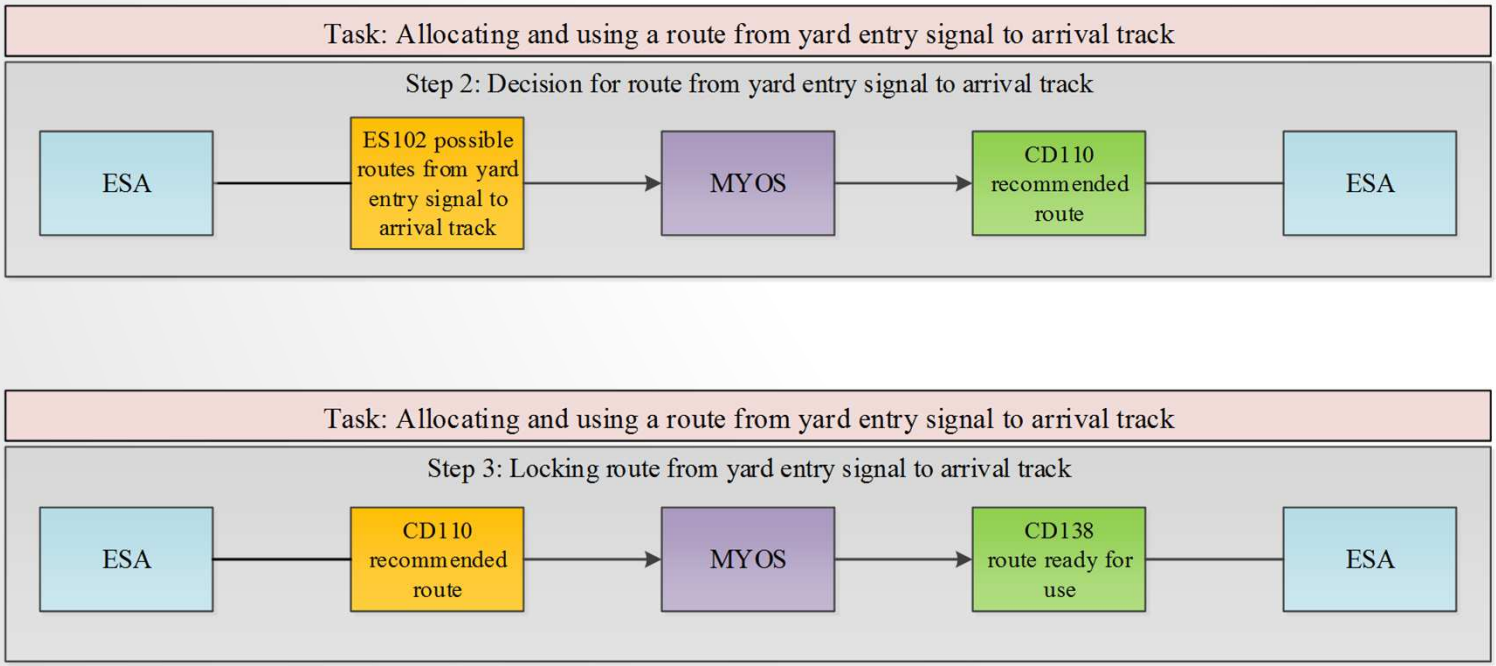
Universal structure to describe steps :



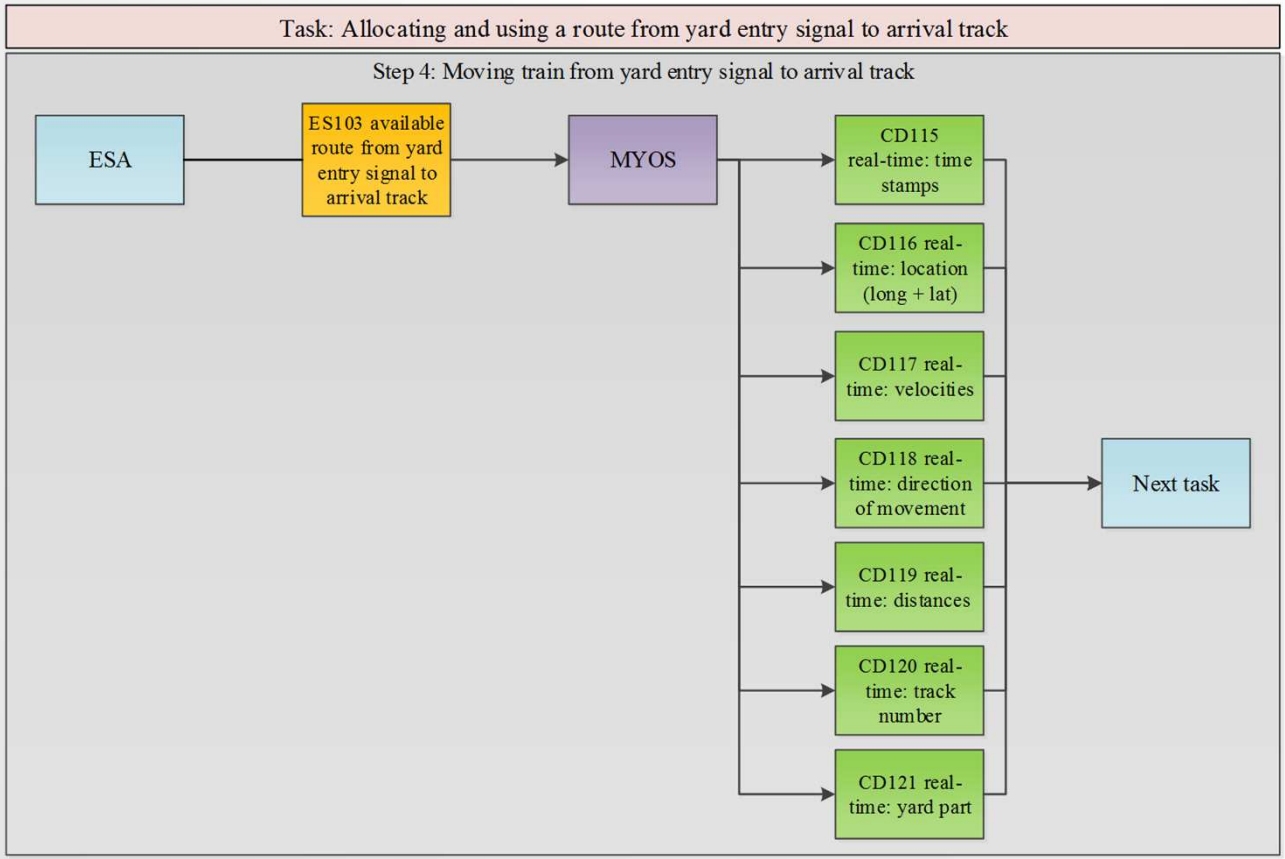
T5.1 - EXAMPLE – STEP 1



T5.1 - EXAMPLE – STEPS 2 AND 3



T5.1 - EXAMPLE – STEP 4



T5.1 - ATTRIBUTES OF INTERFACE

Technical data	Technological data	Information system data
Length of train unit	Transfer of wagon (to which train)	Sender info (ID)
Braking power rate	Direction of wagon	Recipient info (ID)
Maximum speed	Transfer of wagon (in which station)	Train driver
Type of locomotive	Train ID number	Phone number of train driver
Length of wagon	Number of wagon	Equipment by tablet
Number of axles	Order of wagons in train	Path ID
Weight of wagon	RID / dangerous goods	DISC OŘ train number
Weight of shipment	Firm/priority transfer of wagon	Actual position (station)
Traction (in-/dependent)	Info for manipulation (limits/regulation)	Actual position (GPS)
	Planed activities (actual) e. g. arrival technical inspection	Arrival track
	Estimated time of arrival (to point e. g. MY)	Departure track
	Estimated time of departure (from point e. g. MY)	Executive railway undertaking
	Number of train unit (case of unit train)	Licenced railway undertaking
	Type of transportation (unit train, single wagon load, special, military)	Available path in direction
	Maximum time of departure (each wagon) – railway undertaking requirement	Available time for departure
	Train confidence	Code of data group
	Origin station of wagon	Other note
	Destination of wagon	
	Track	
	Switches	

T5.2 - IMPROVED DECISION SUPPORT SYSTEM AT THE YARD LEVEL

M6-M22 → March 2018 - July 2019

Lead: IFSTTAR

Contributors: DICEA, OG, UIRR, NEW OPERA, UNEW

Focus: optimization algorithms for yard operations

Objective: analyze the state of the art and propose a novel effective decision support tool

Aimed result: optimization algorithm for real-time yard management, incorporating information coming from the network (TRL4)

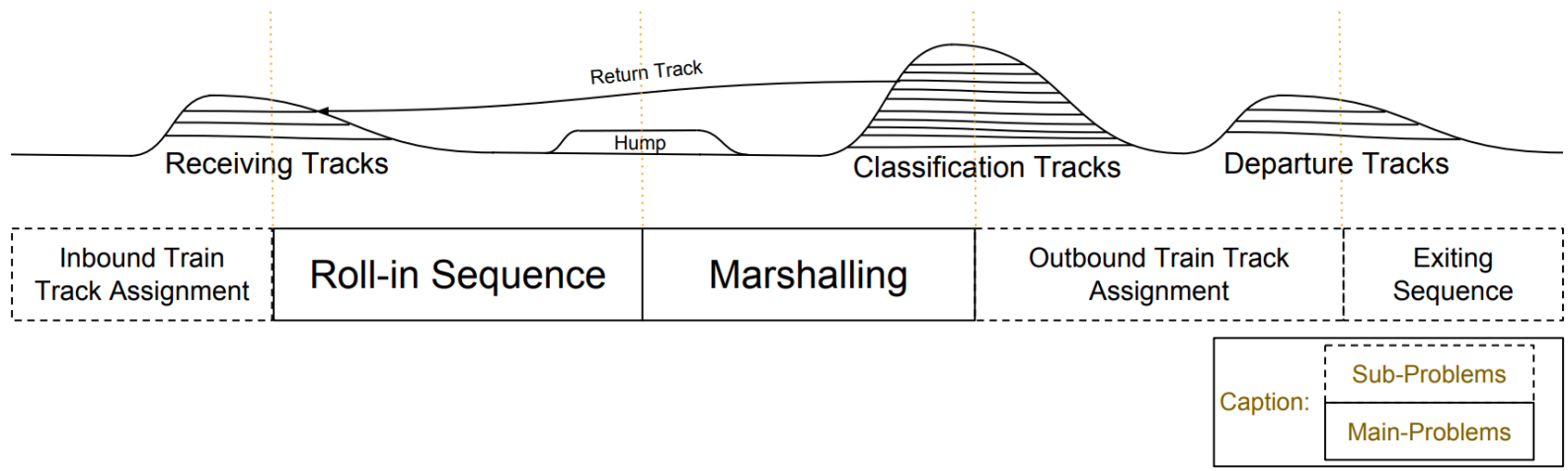
T5.2 – ANALYSIS OF THE LITERATURE (1)

Only the main tracks are taken into account

No work related to the optimization of specific yard like in Trieste

The **overall problem** has never been object of comprehensive study

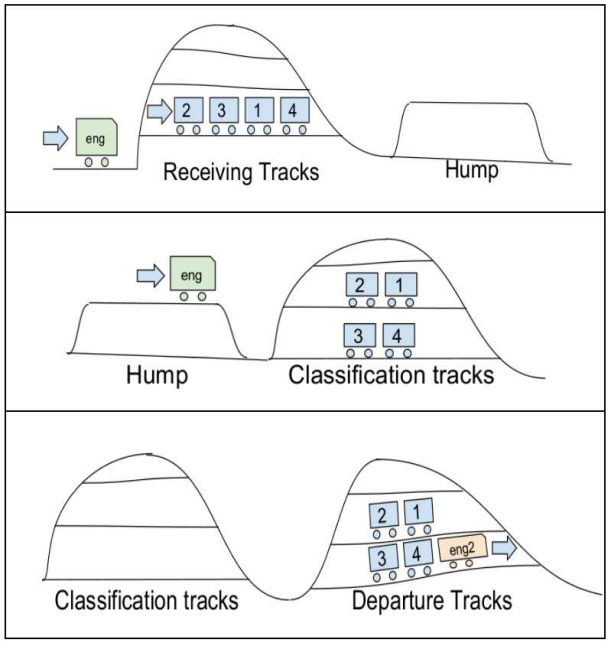
The available papers focus on **sub-problems**

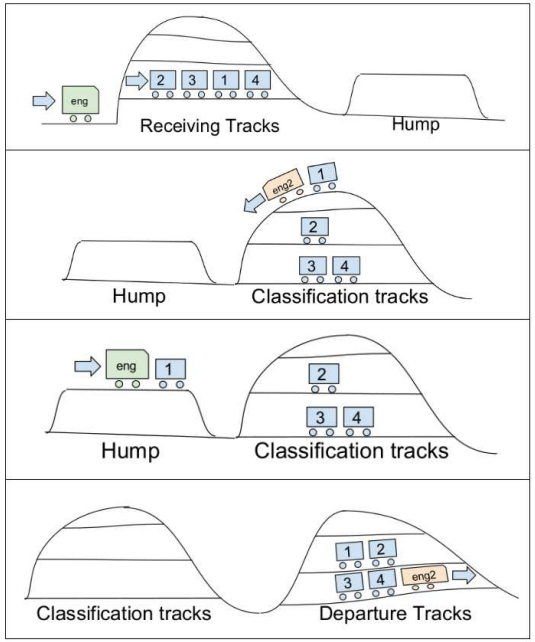


T5.2 – ANALYSIS OF THE LITERATURE (2)

Movements of locomotives are not modeled

The problems are split into **single**-stage, **multi**-stage with **mixing tracks**, **multi**-stage with **cars sorting**

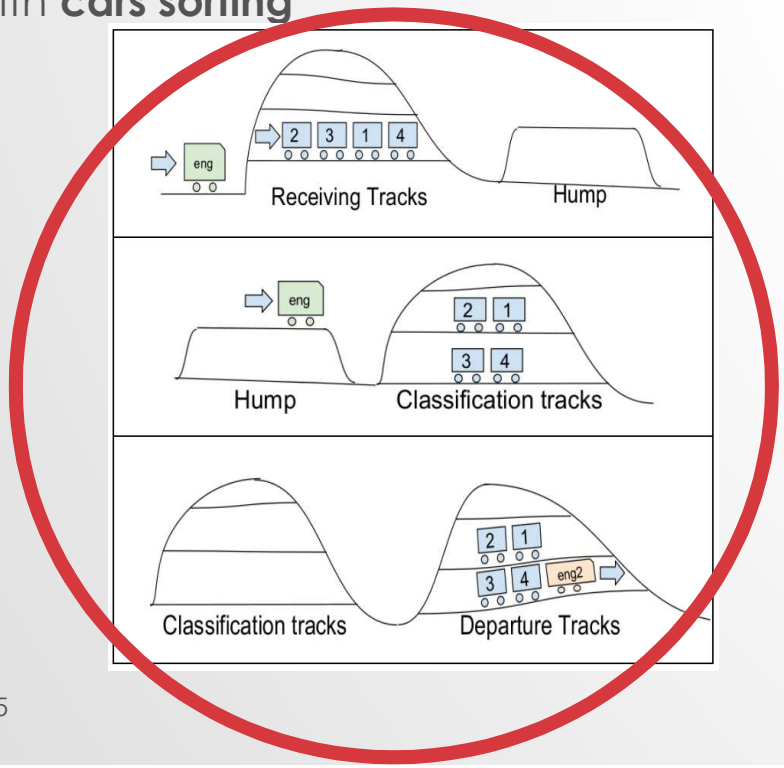


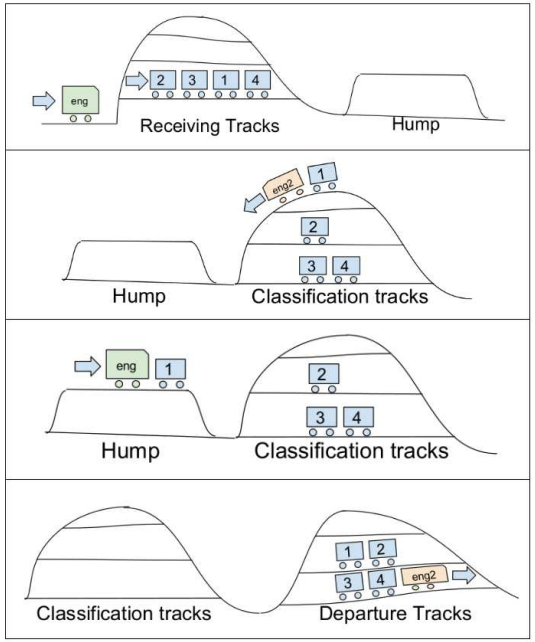


T5.2 – ANALYSIS OF THE LITERATURE (2)

Movements of locomotives are not modeled

The problems are split into **single**-stage, **multi**-stage with **mixing tracks**, **multi**-stage with **cars sorting**





T5.2 – CURRENT AND NEXT STEPS

Write a generic model to be used for CT & Trieste,

Determine the criteria to consider, e.g. :

- minimize the number of classification tracks used,
- minimize the delays of the outbound trains (after EDT) ;

Determine the available time *t* to take a decision

Implement an algorithm according to the criteria and computation time *t*

T5.2 – CURRENT AND NEXT STEPS

OPTIMIZATION MODEL

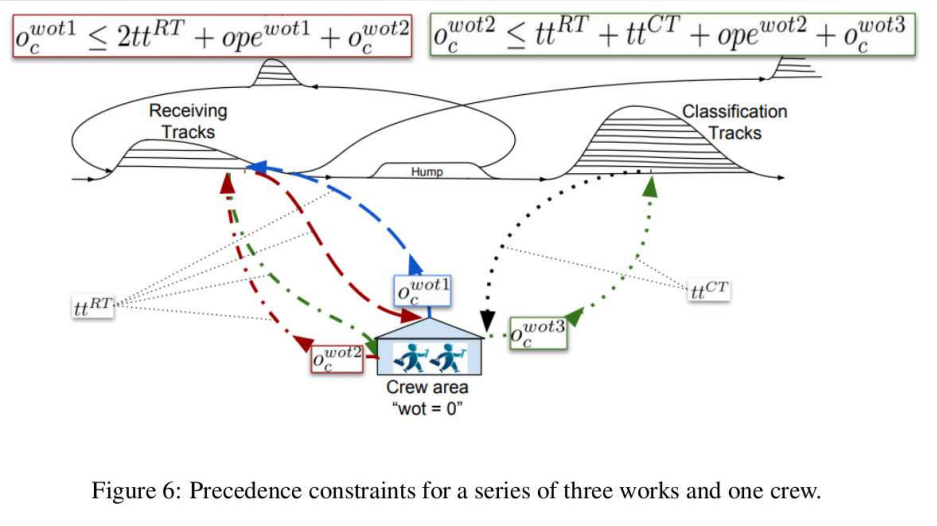


Figure 6: Precedence constraints for a series of three works and one crew.

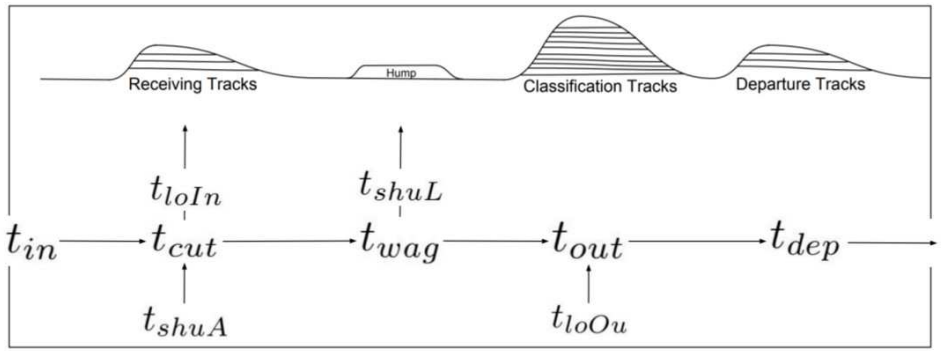


Figure 3: Sequence of trains with at least one car in common

T5.3 - IMPROVED DECISION SUPPORT SYSTEM AT THE NETWORK LEVEL

M6-M22 → March 2018 - July 2019

Lead: LEEDS

Contributors: IFSTTAR, OG, NEW OPERA, UNEW, TUD

Focus: decision support for the integration of network traffic states into yard optimization

Objective: analyze the state of the art and propose a suitable algorithm

Aimed result: algorithm for the integration of yard management optimization into the network (TRL3)

T5.4 - DEFINITION OF THE INTEGRATED FRAMEWORK OF OPTIMIZATION AND SIMULATION

M10-M24 → July 2018 - September 2019

Lead: IFSTTAR

Contributors: SIMCON, OG

Focus: integration of the yard and network optimization algorithms and simulation

Objective: define and implement a closed-loop of simulation and optimization

Aimed result: integrated framework to be used in the demonstration in WP6



QUESTIONS

Thank you for your attention!

Joaquin Rodriguez (joaquin.rodriguez@ifsttar.fr)