Legal and Business Considerations when Implementing Optimized Railway Dispatch

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Legal and Business Considerations when Implementing Optimized Railway Dispatch

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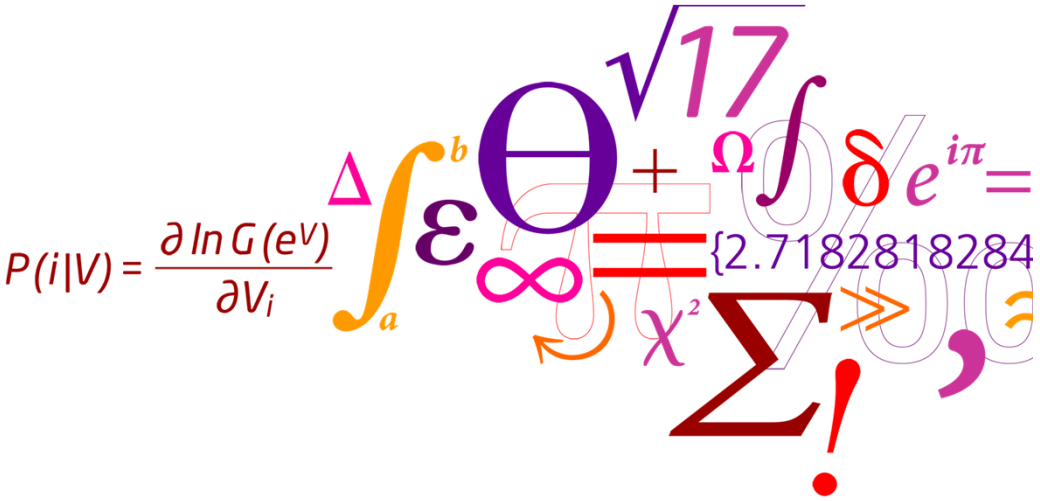

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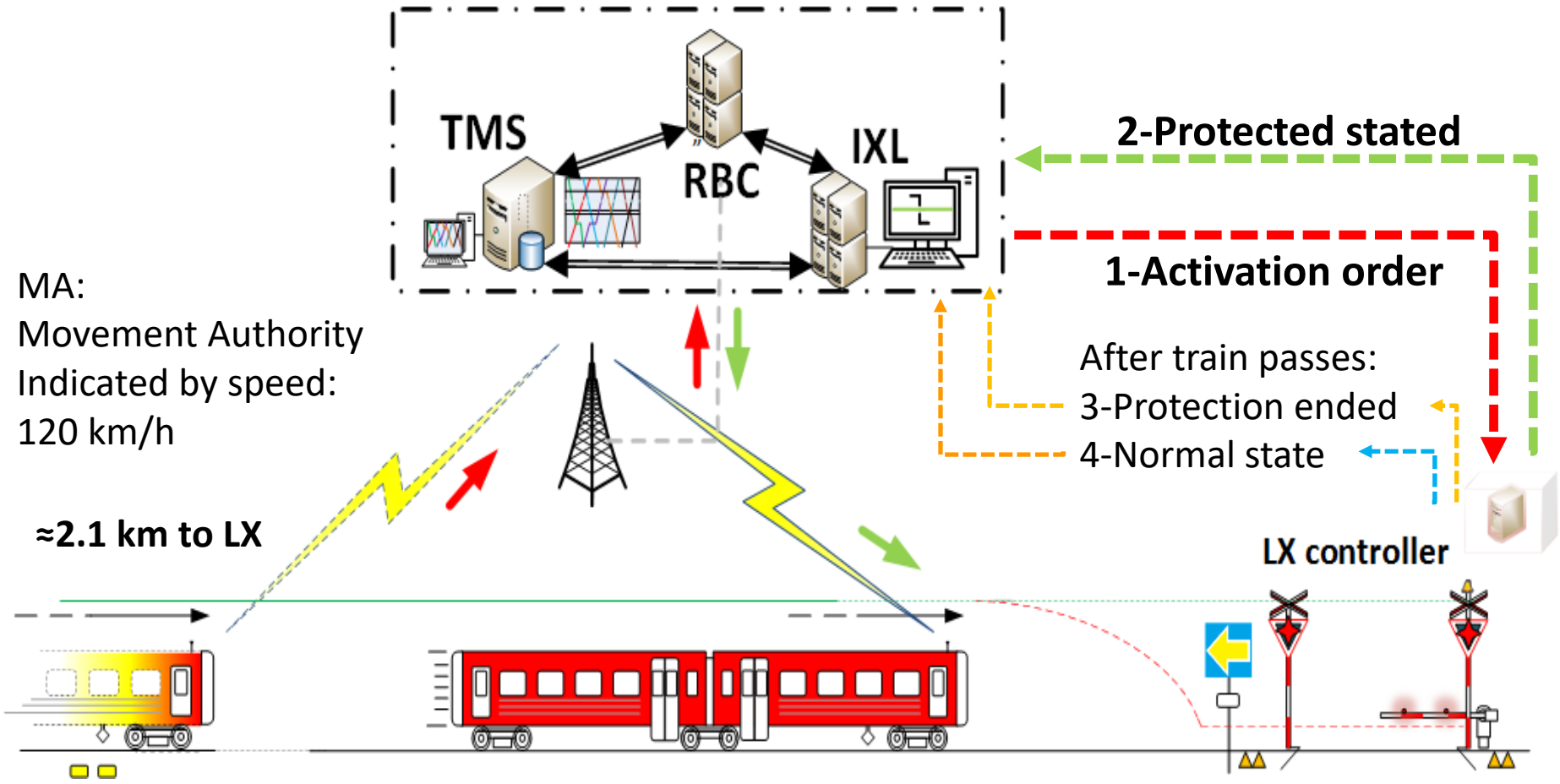
Introduction

- A business model for optimized railway dispatching, motivated by ERTMS
- An example of today's typical dispatching decision
- Open access railway systems and relevant EU and national law
- The European Railway Traffic Management System and proposals for automation or optimization
- Lessons from airline traffic
- A proposed hierarchy for traffic plan change management

What is ERTMS?

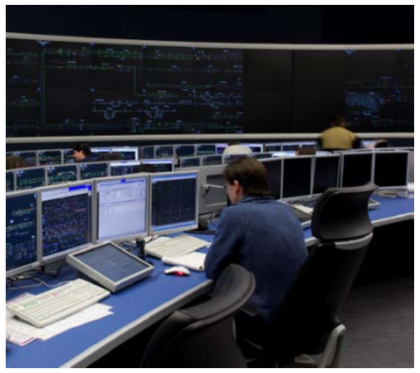
A completely digital,
computer managed rail traffic control system



MA:
Movement Authority
Indicated by speed:
120 km/h

Railway systems are making a generational shift to digital control

- Simultaneously, mathematical programming has advanced
- Numerous demonstration projects for dynamic, optimal dispatch have occurred, e.g. Norway, Switzerland, and northern Italy
- Reynolds (2019) demonstrates solution time of 20 seconds for train path planning in Doncaster Station, UK

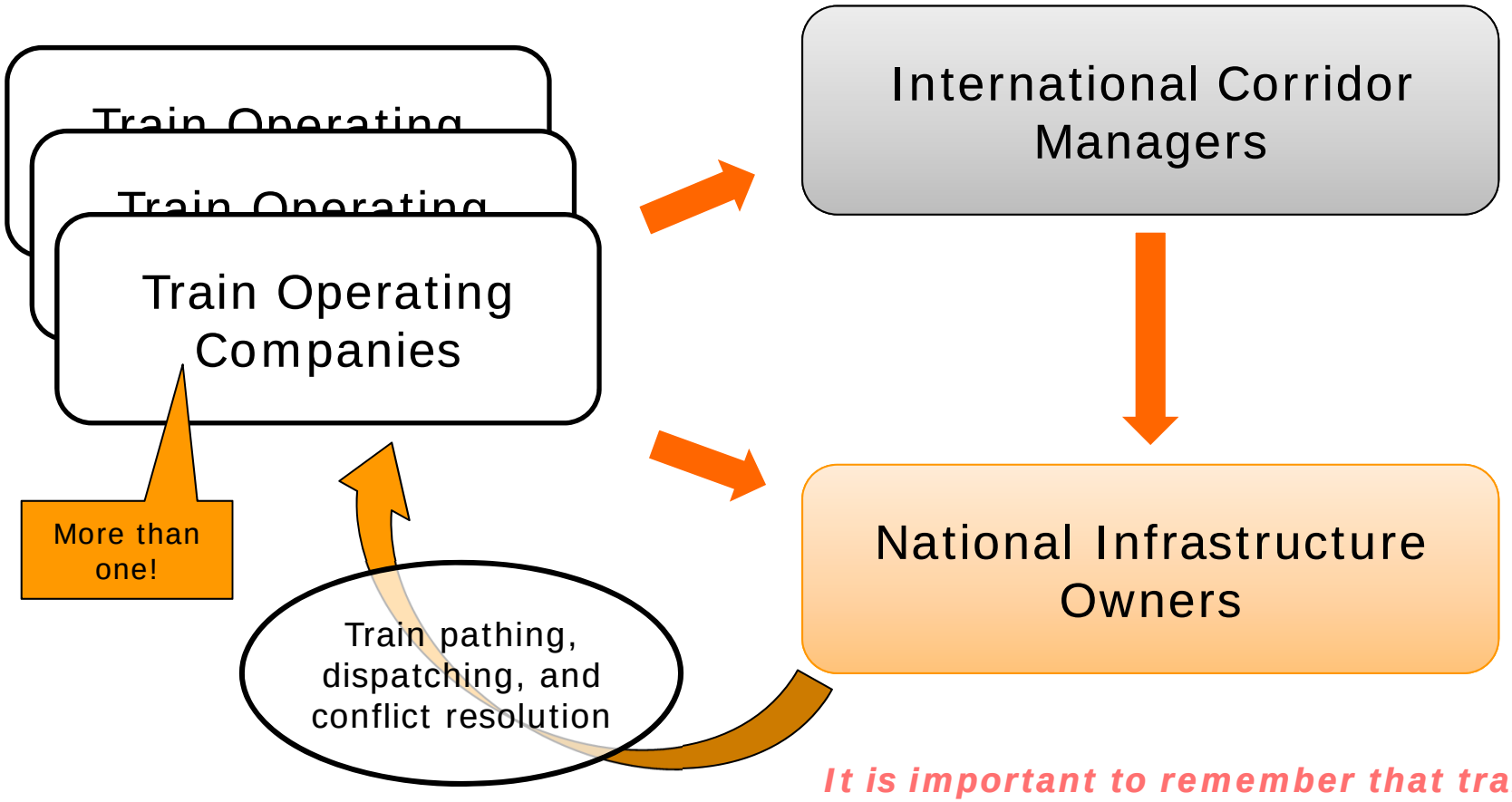


If we can – does it mean we always should?

The EU railway hierarchy today

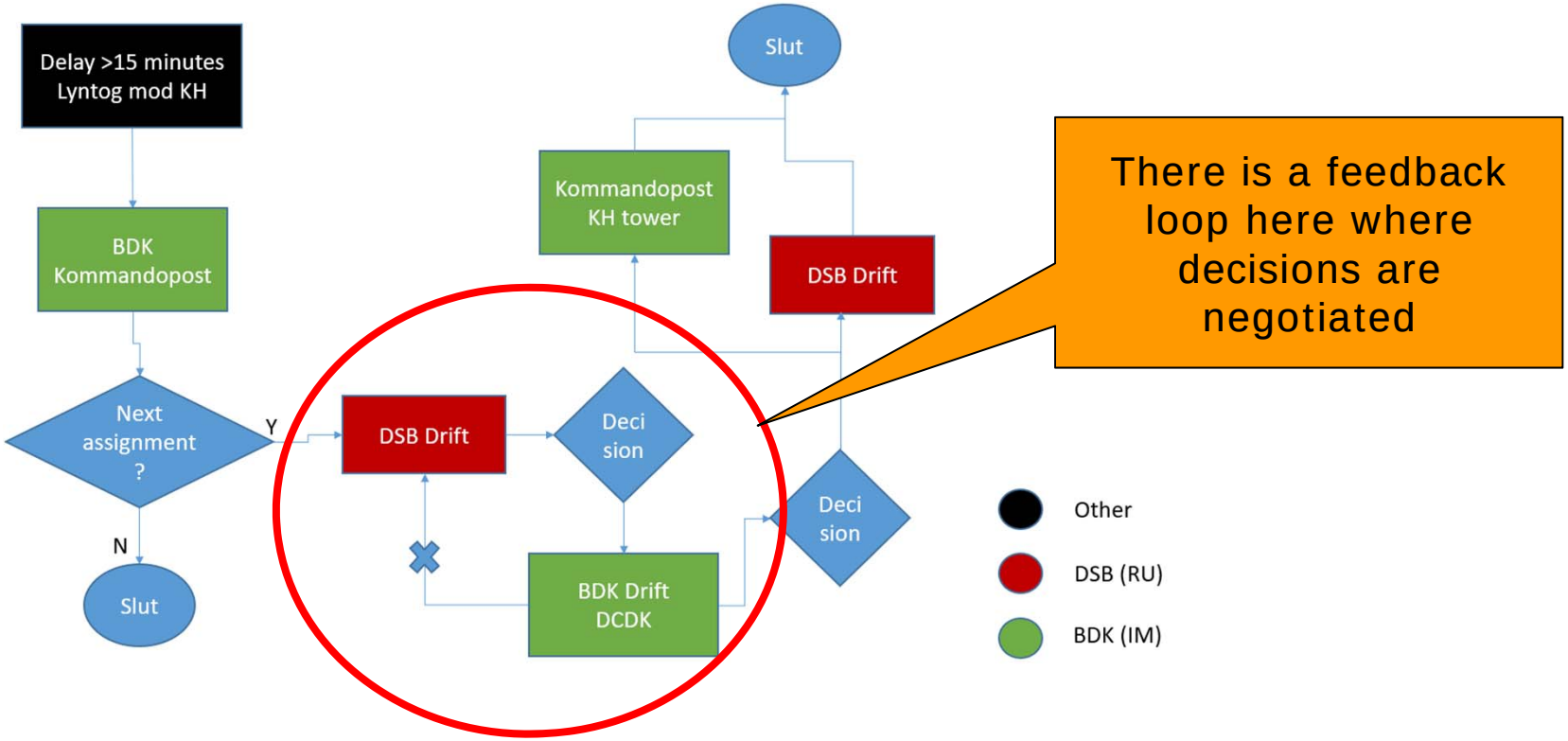
- By EU law, the European railway network is ”open access”
- Management of infrastructure is *separate* from operation of trains
- Train pathing and dispatching is separate from, but also *neutral* in relationship to, train operation.
- This neutrality is a firm expectation in EU law

Typical EU railway control hierarchy



It is important to remember that train operating companies are customers of the infrastructure managers.

Today – dynamic changes to train movements are a cooperative process between infrastructure manager and train operator



Negotiation process is quite important

- EU and national law define a railway market where competition is encouraged, and neutrality of the infrastructure manager is strictly enforced
- Under no circumstances, can an infrastructure manager sell transport services, make marketing decisions, or show bias or favoritism to one train operator over another
- For example, Danish law provides detailed instructions for non-discriminatory management of train paths
- The goal after any disruption is always a return to the contractually agreed train paths

Directive 2012/34/EU

The charging and capacity-allocation schemes should permit equal and non-discriminatory access for all undertakings …

In particular, the infrastructure manager shall ensure that infrastructure capacity is allocated in a fair and non-discriminatory manner and in accordance with Union law.

And amendment 2016/2370…

Member States shall ensure that the functions of traffic management and maintenance planning are exercised in a transparent and non-discriminatory manner…

Member States shall ensure that railway undertakings, in cases of disruption concerning them, have full and timely access to relevant information.

Some new concepts of optimal replanning of train services

- Researchers in Switzerland have proposed the concept of ”service intentions” (Wüst & Caimi 2008)
  - Timetable commitments are replaced with commitments to passengers
  - Scheduling of *passengers* instead of *trains*
- Computer dispatching then continuously re-plans train paths to minimize passenger delays
- The goal is no longer to enforce the timetable, but instead to enforce the ”service intentions” with a ”production plan”

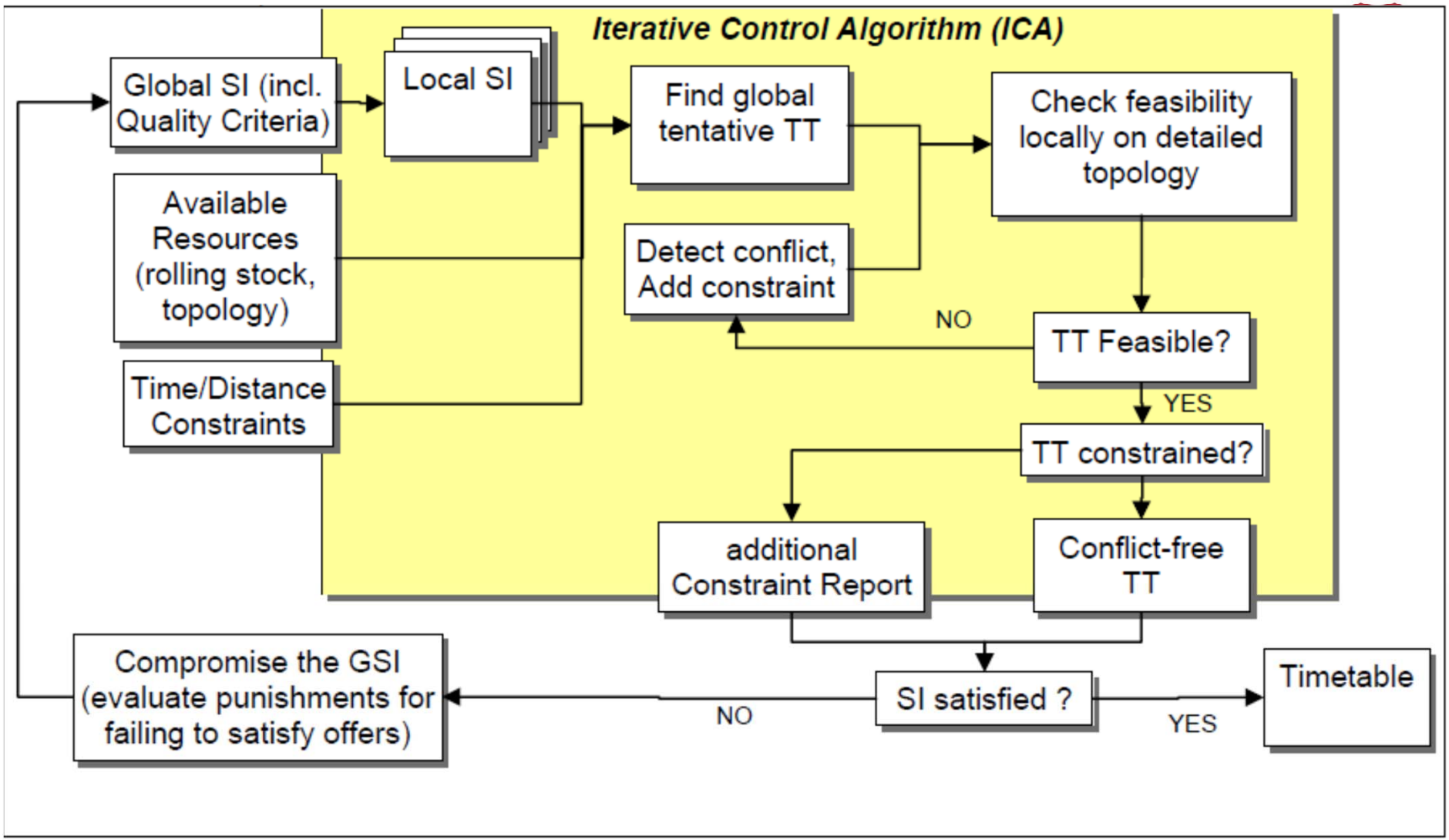


Figure 3: Process overview of timetable generation using the ICA

Wüst & Caimi 2008

Conflict between ”service intentions” and Open Access

- Switerland is not a member of the EU
- The Swiss transport network is vertically integrated, and not open access
- Central planning based on service intentions requires sharing of confidential business information
- It is not convincing that customers will accept last minute changes to reservations, based on airline experience

How does a firm manage seat and meal reservations, and crew assignments, if train paths are changing every 30 seconds?

Examples from air traffic control

- Airlines operate in a similar ”open access” separation of infrastructure and operator
- The complexity of airline operating plans is such that the costs of flight crew and equipment changes are much greater than schedule delays
- In the USA, the FAA has implemented Collaborative Decision Making (CDM) to better manage these decisions without compromising the competitive independence of the airlines

Resolution of conflicting expectations with a tiered approach

- The railway industry faces two conflicting developments
  - Advances in technology that suggest continuous train re-planning every 30 seconds
  - Market based, competitive train operating companies that require stable contractual commitments
- Further, any automatic or autonomous train re-planning system needs to avoid ”nervousness”, as known in MRP systems in manufacturing

The tiered approach

- Divide the re-planning response into levels
  - Technical revision – delays or changes less than 3 minutes
  - Tactical revision – delays or changes 3-6 minutes
  - Service revision – all other magnitudes of change
- Each level offers increasing levels of supervisory coordination with the train operating companies

Summary of change capabilities

Capability	Technical Revision	Tactical Revision	Service Revision	
Train Operating Company Consulted			X	
Train Operating Company Informed in Advance		X	X	
Changes to train path in infrastructure	X	X	X	
Changes to platforms at stations		X	X	
Maximum allowed train retiming, minutes	3	6	99	
Changes to train stops allowed			X	
Cancellation of trains allowed			X	

Summary

- EU open access is based upon very strong independent and contract based business rules
- Mathematical optimization and ERTMS offer major new capabilities in train dispatching
- These capabilities disrupt the organizational structure of open access railways
- A tiered approach is necessary to retain collaborative decision making during the most disruptive re-planning actions

Thank you and “vi ses”

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