

# More trains, better connections

## Rail Traffic Management using ATO

Mini Conference on Technological Perspectives and Scientific Challenges of ATO  
CFSM, ETH Zurich, 12.12.2024

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**SIEMENS**

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## Rail Traffic Management using ATO

### Agenda

1 State of the Art

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2 Mainline Application

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3 Reference Projects

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4 Conclusion

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# State of the Art

# Automatic Train Operation – Mass Transit (MT) and Mainline (ML) Applications

MASS TRANSIT

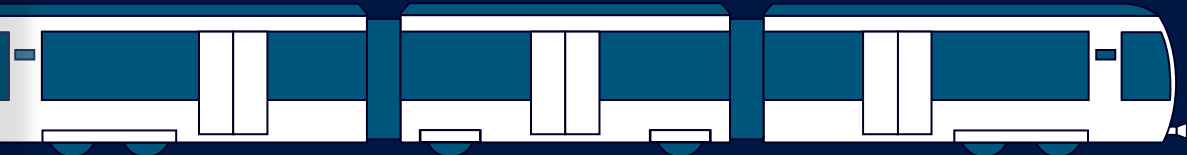
One operator for infrastructure and rolling stock

Passenger traffic

Homogenous fleets with unique characteristics

Separated rail network with limited access

Single vendor proprietary solution as a viable option



MAINLINE

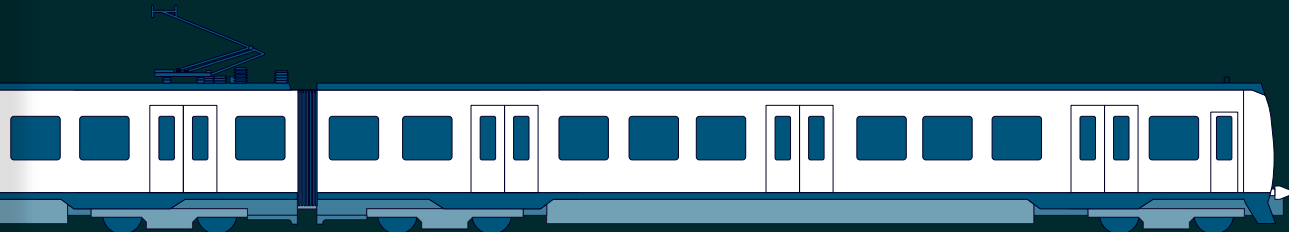
Separate operators for infrastructure and rolling stock

Mixed traffic high speed/regional, cargo





Mixed fleets with individual characteristics

Complex rail network publicly accessible

Interoperable solutions across different suppliers required



# Automatic Train Operation – Grade of Autonomy (GoA)

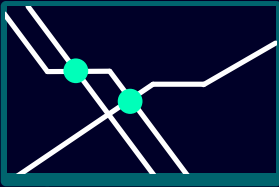
GoA1	GoA2	GoA3	GoA4
<p>Non-Automated Train Operation</p>	<p>Semi-Automatic Train Operation</p>	<p>Driverless Train Operation</p>	<p>Unattended Train Operation</p>
			
<p>Manual driving</p>	<p>Automated driving</p>	<p>Automated driving</p>	<p>Automated driving</p>
<p>Obstacle detection and track monitoring by driver</p>	<p>Automated obstacle detection and track monitoring</p>	<p>Automated obstacle detection and track monitoring</p>	<p>Automated obstacle detection and track monitoring</p>
<p>Handling of trains at stops by driver</p>	<p>Automated handling of trains at stops (doors)</p>	<p>Attended handling of trains at stops (doors)</p>	<p>Automated handling of trains at stops (doors)</p>
<p>Manual handling of disruptions</p>	<p>Automated handling of disruptions</p>	<p>Automated handling of disruptions</p>	<p>Automated handling of disruptions</p>

# Mainline Application

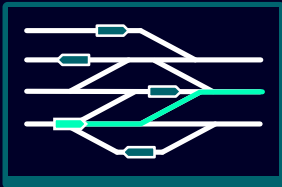
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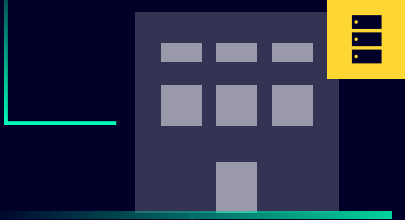
**Dispatching system**  
Forecasting, conflict detection and resolution



**Control system**  
Movement tracking, automatic route setting, remote control



**Interlocking**  
Route and train protection

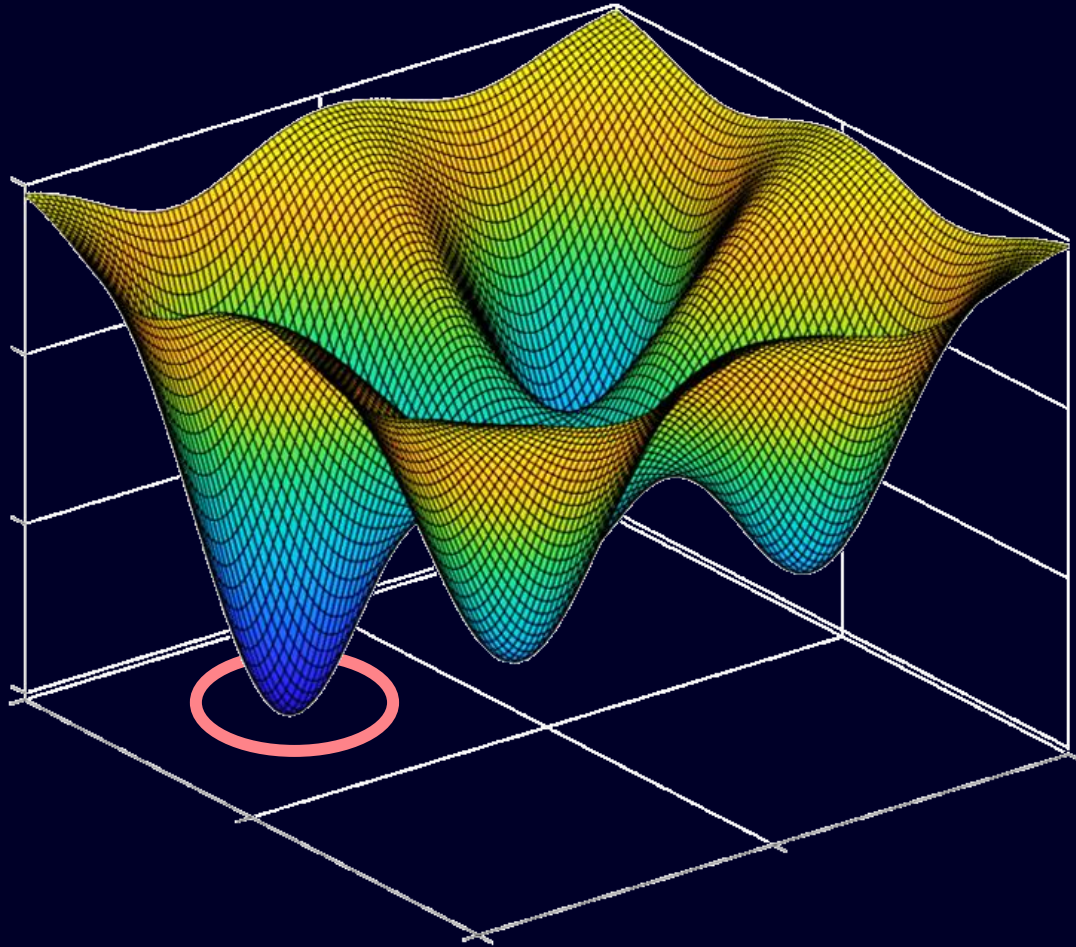


**Wayside and signalling**  
Signals, switches, track vacancy detection and ATP equipment



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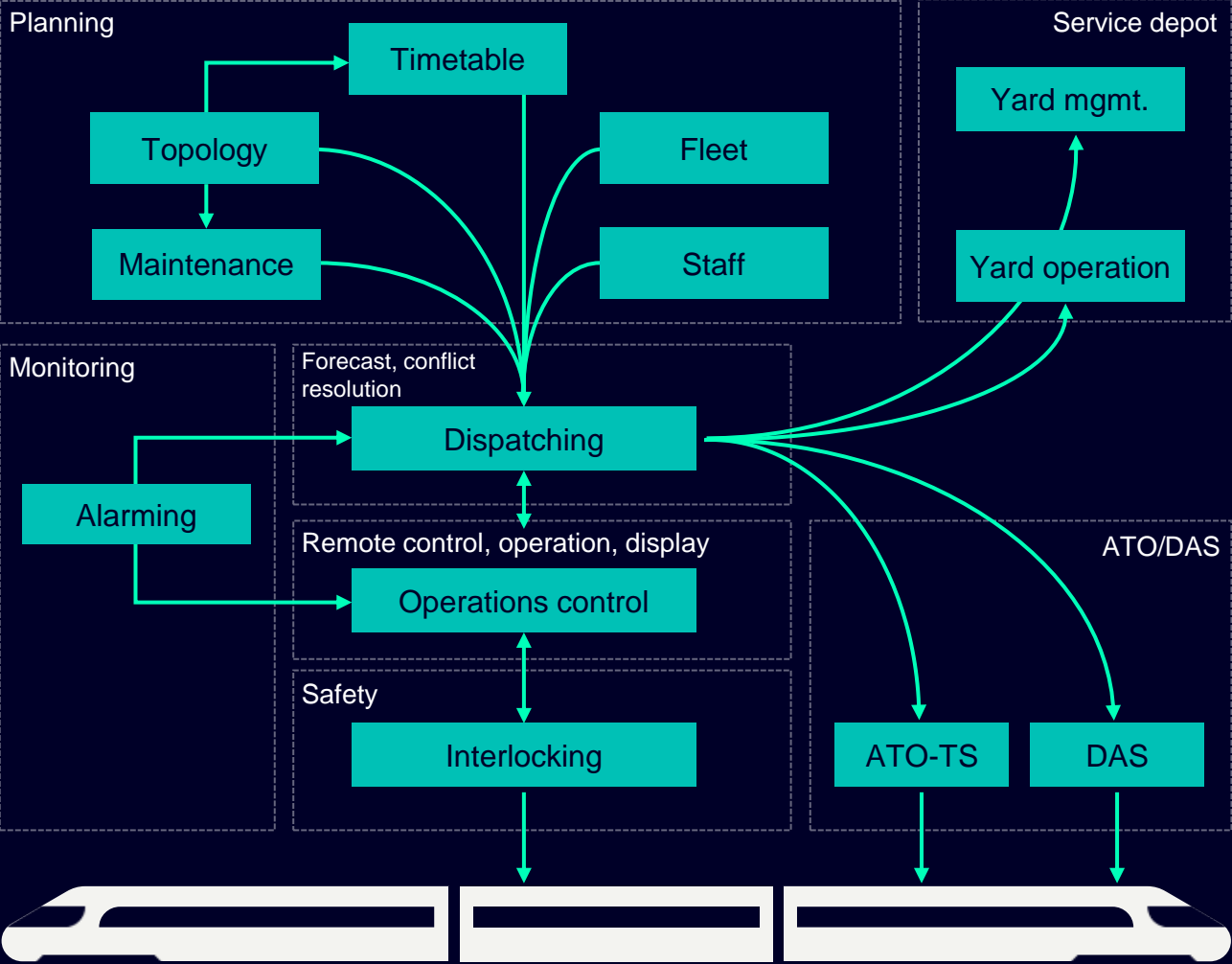


How to find the global minimum to the optimization problem?



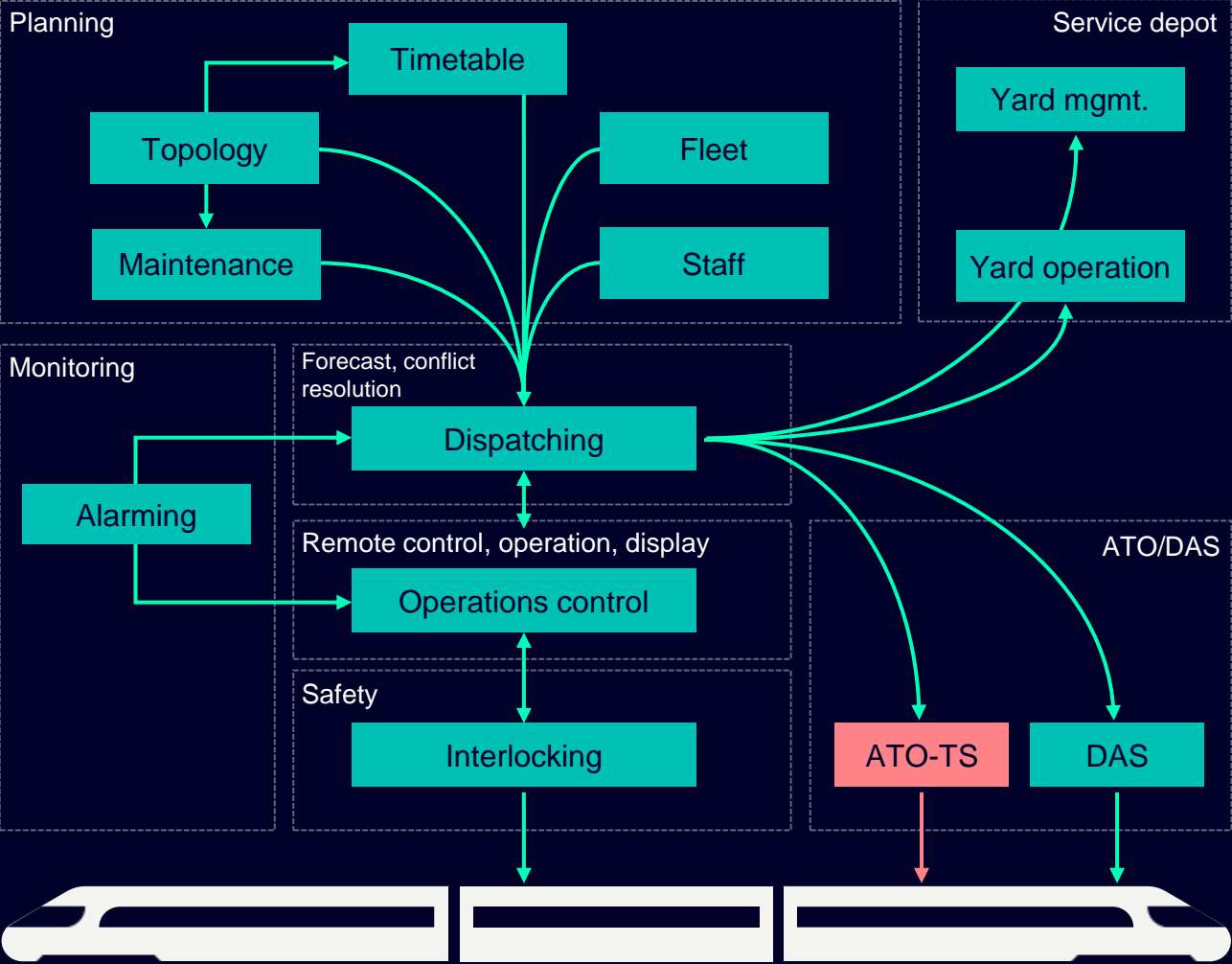
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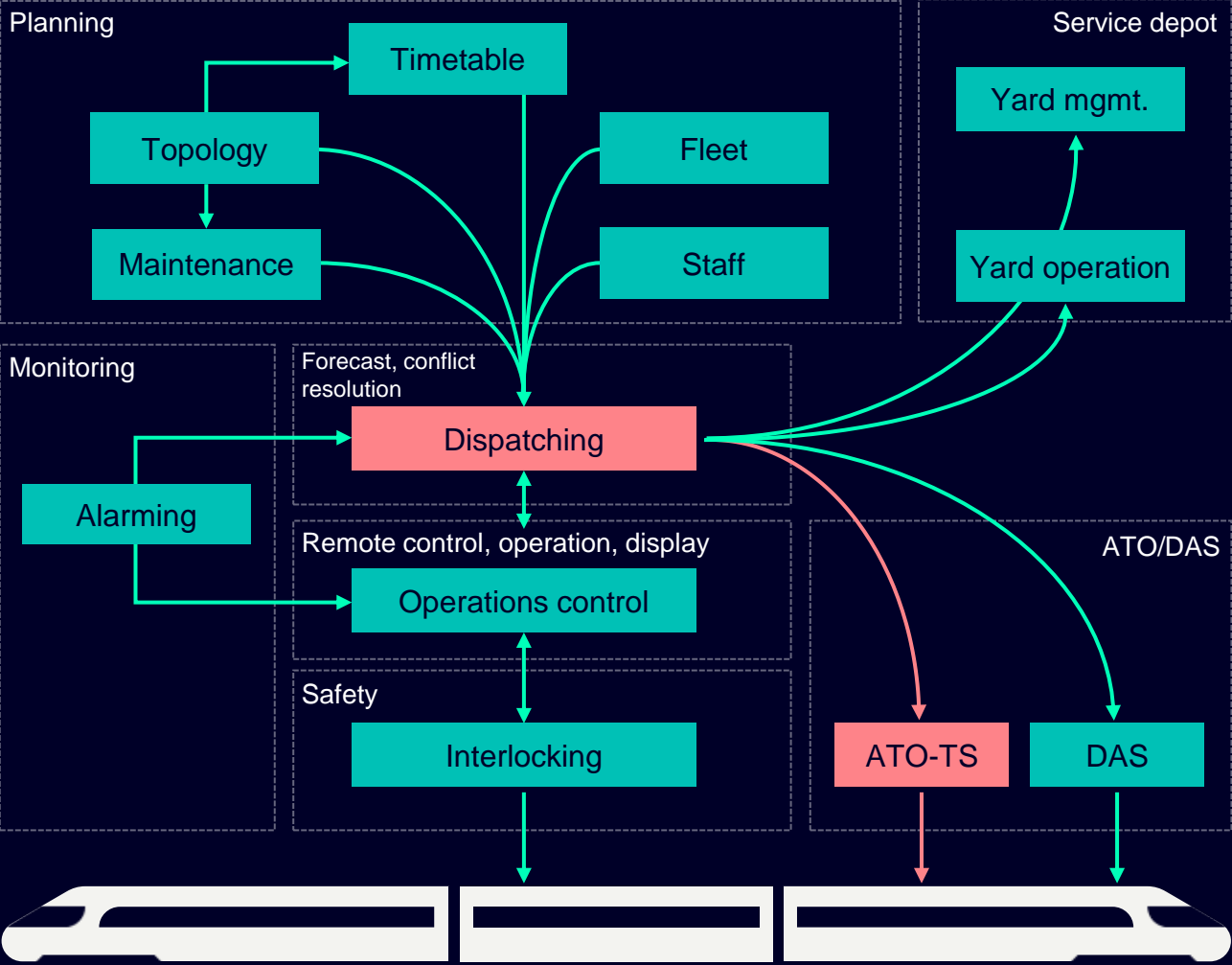
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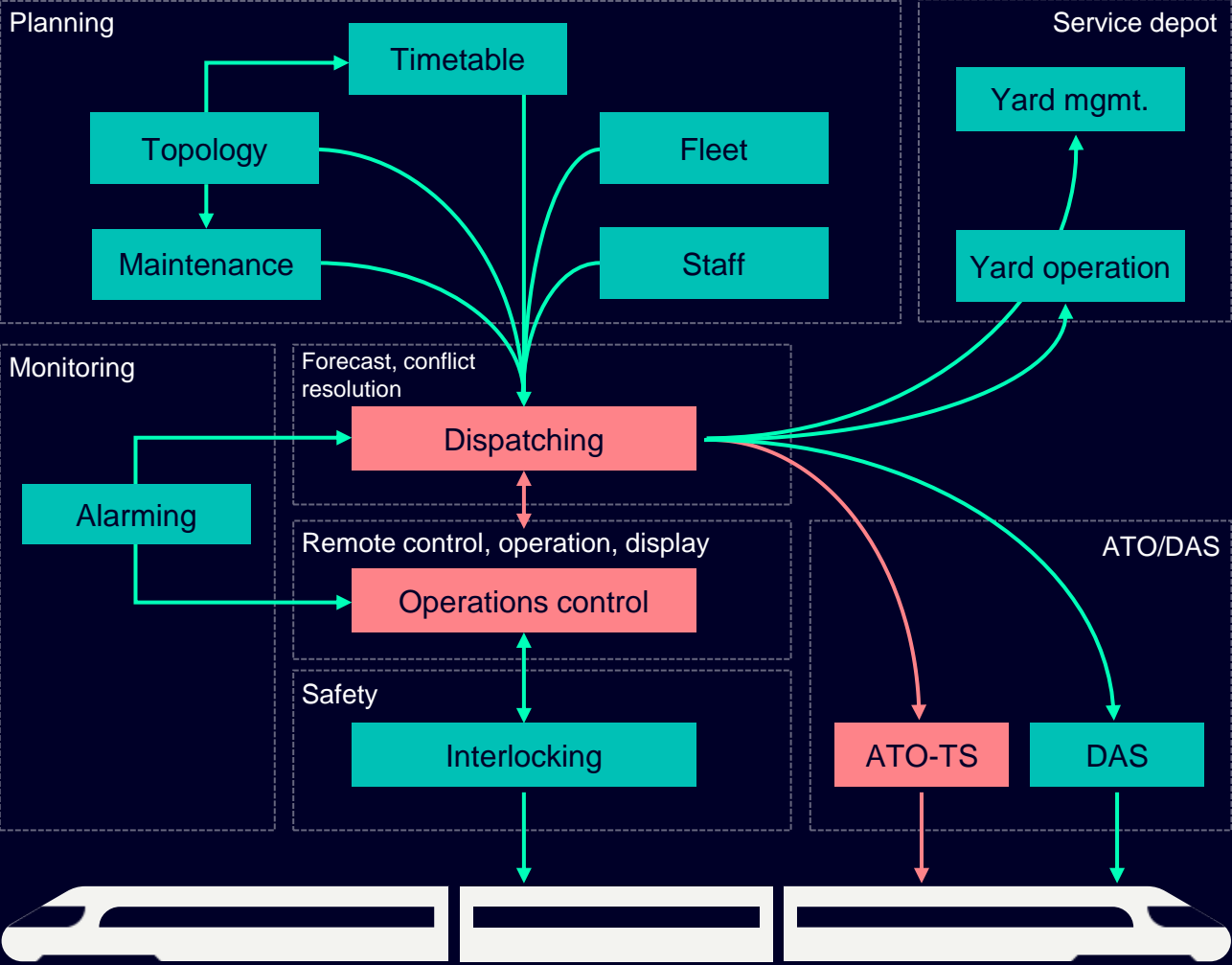
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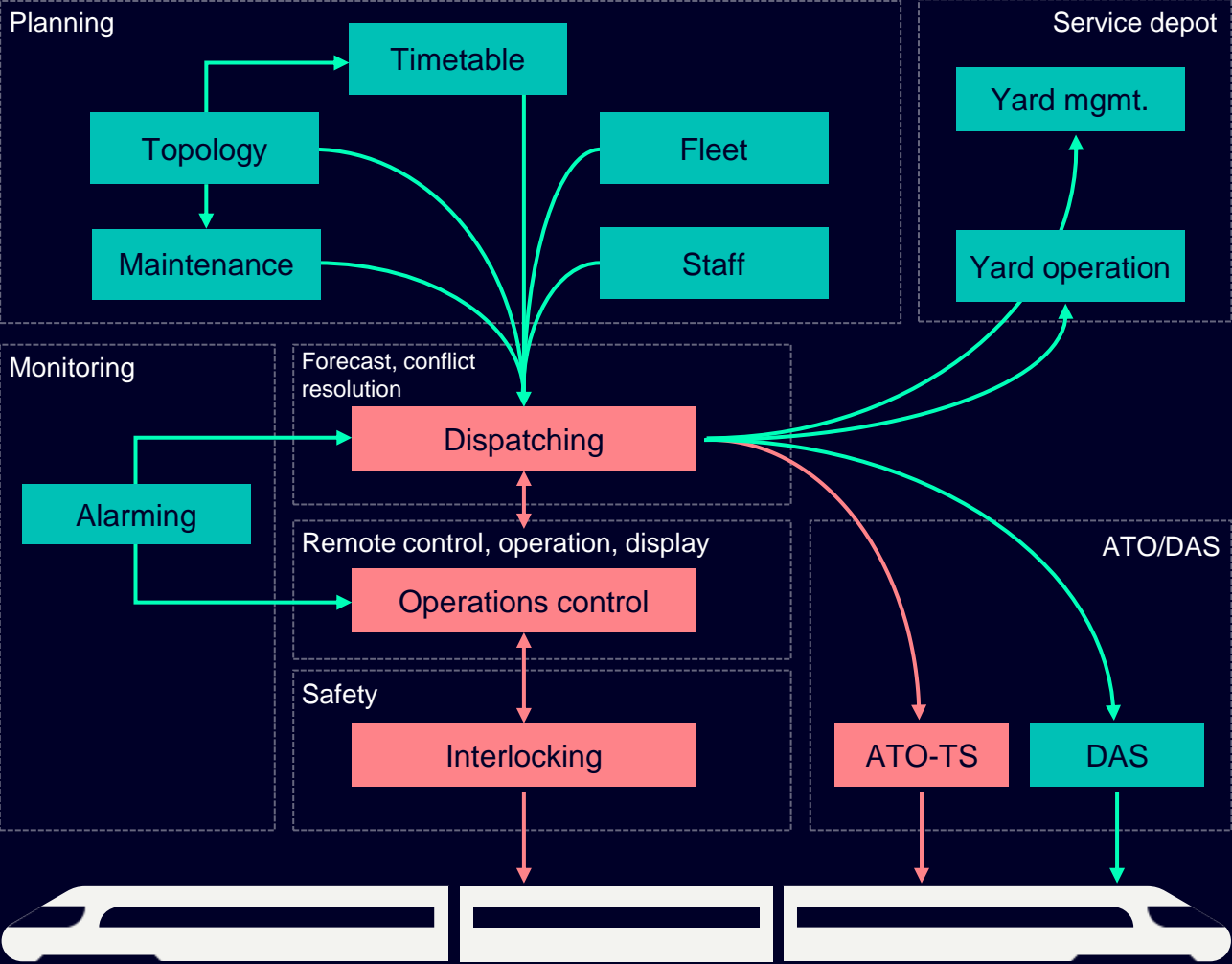
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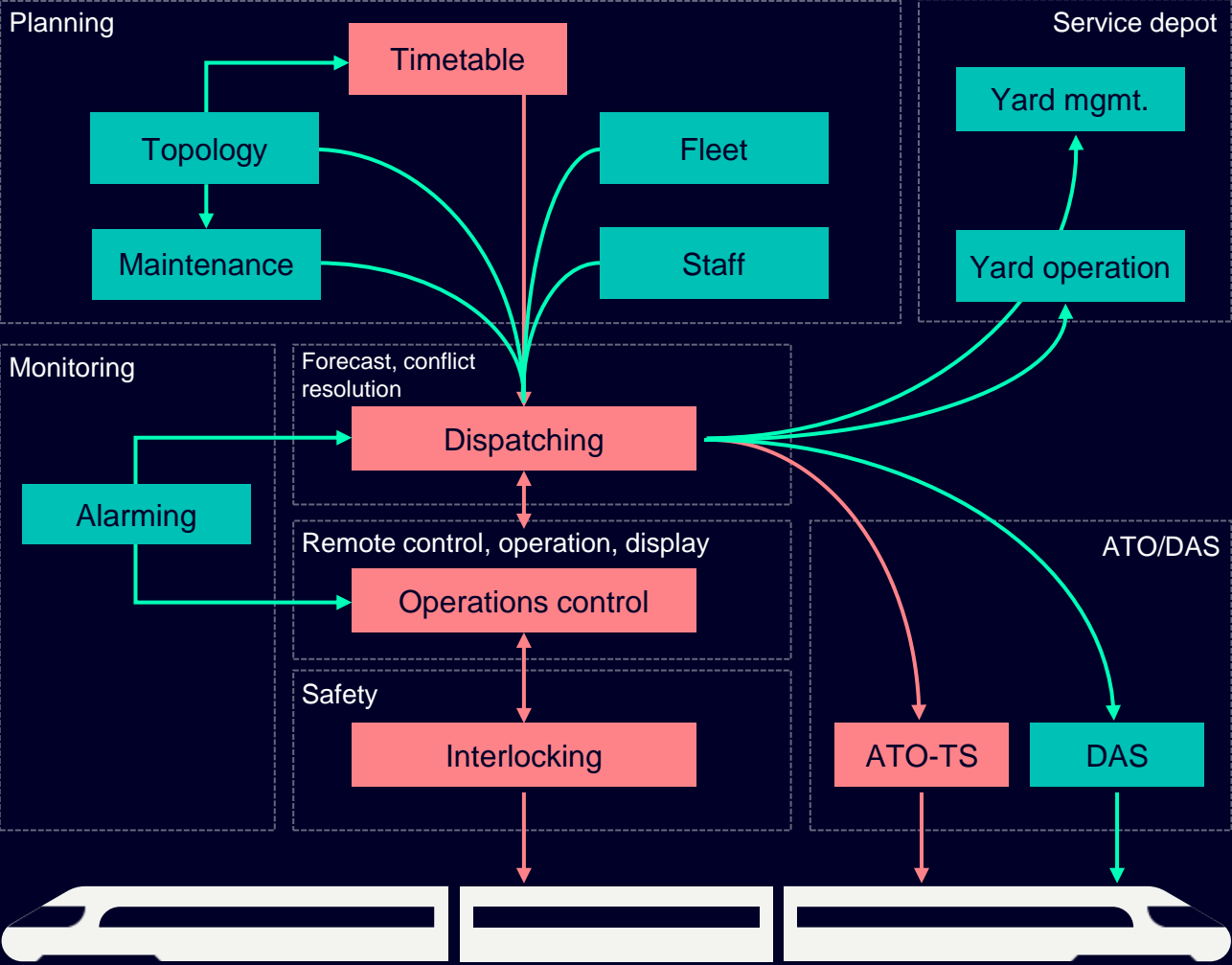
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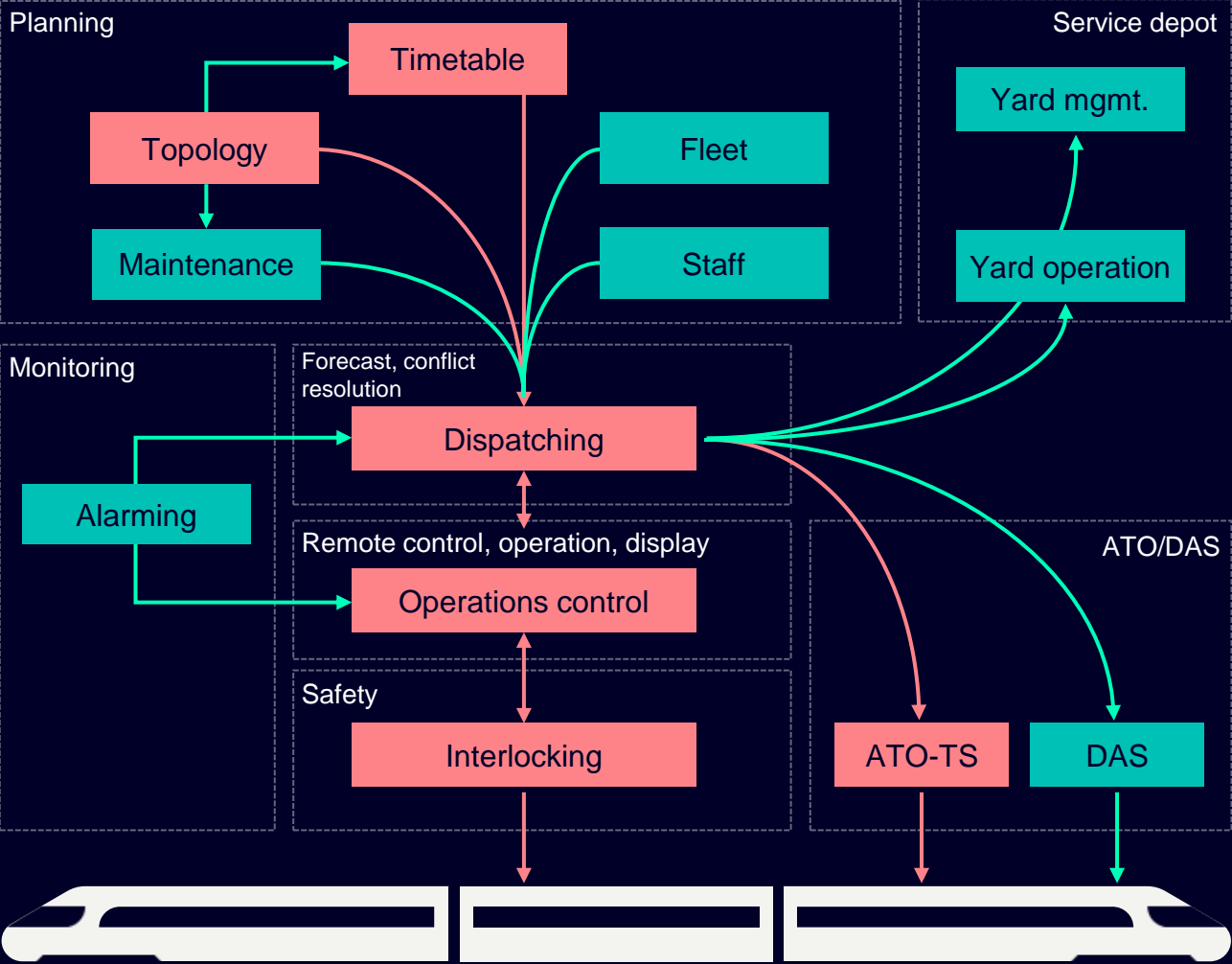
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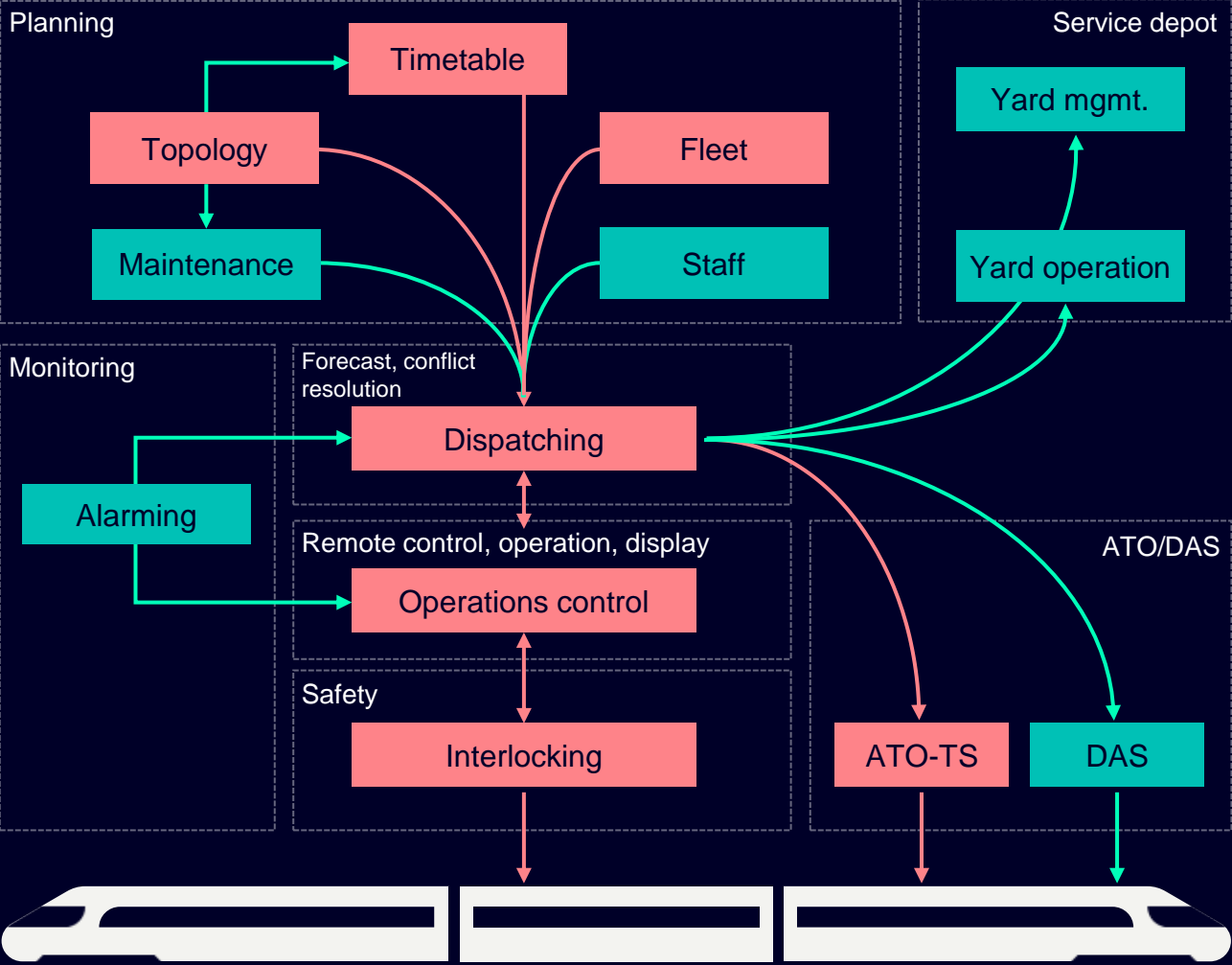
# Rail Traffic Management using ATO

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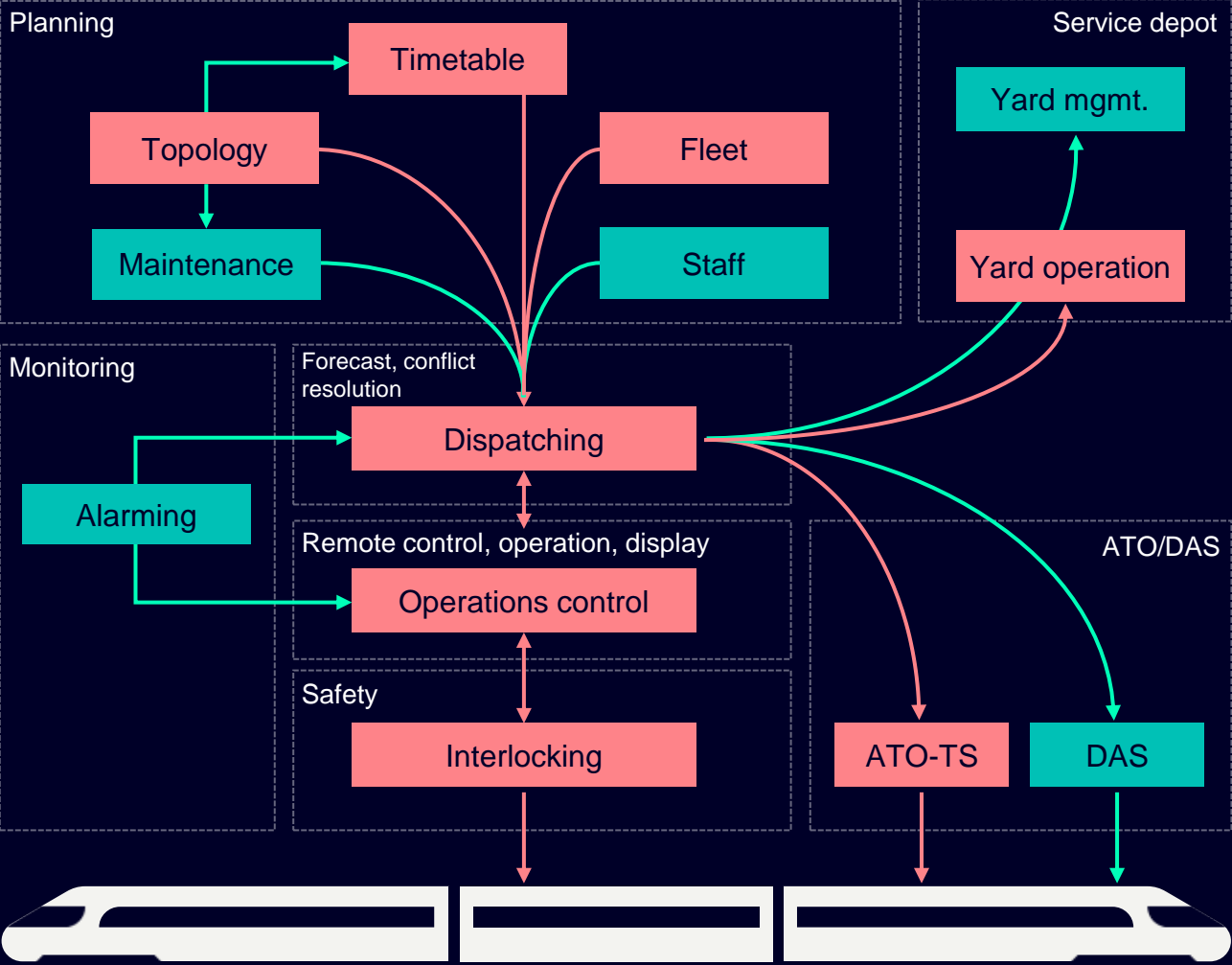
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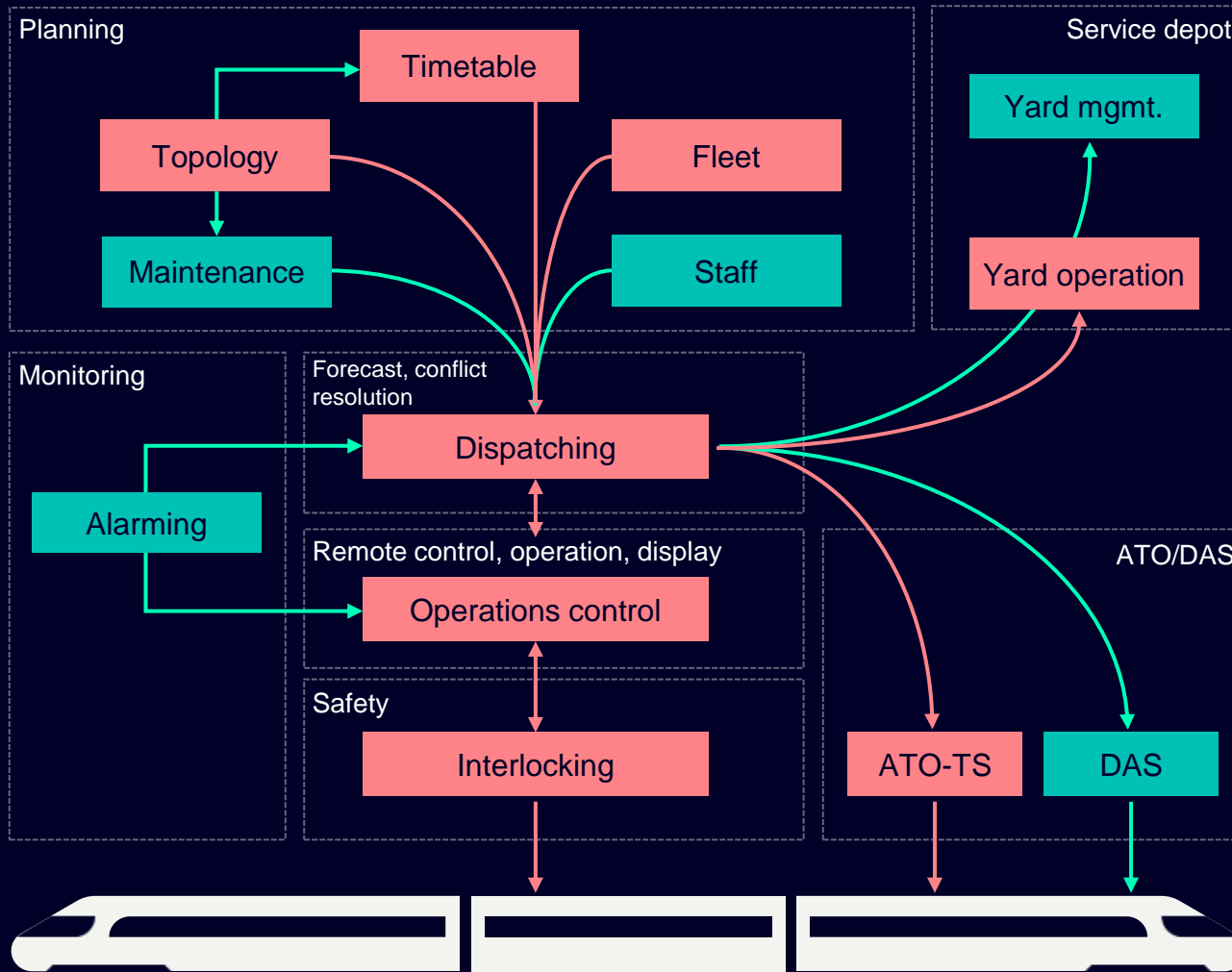
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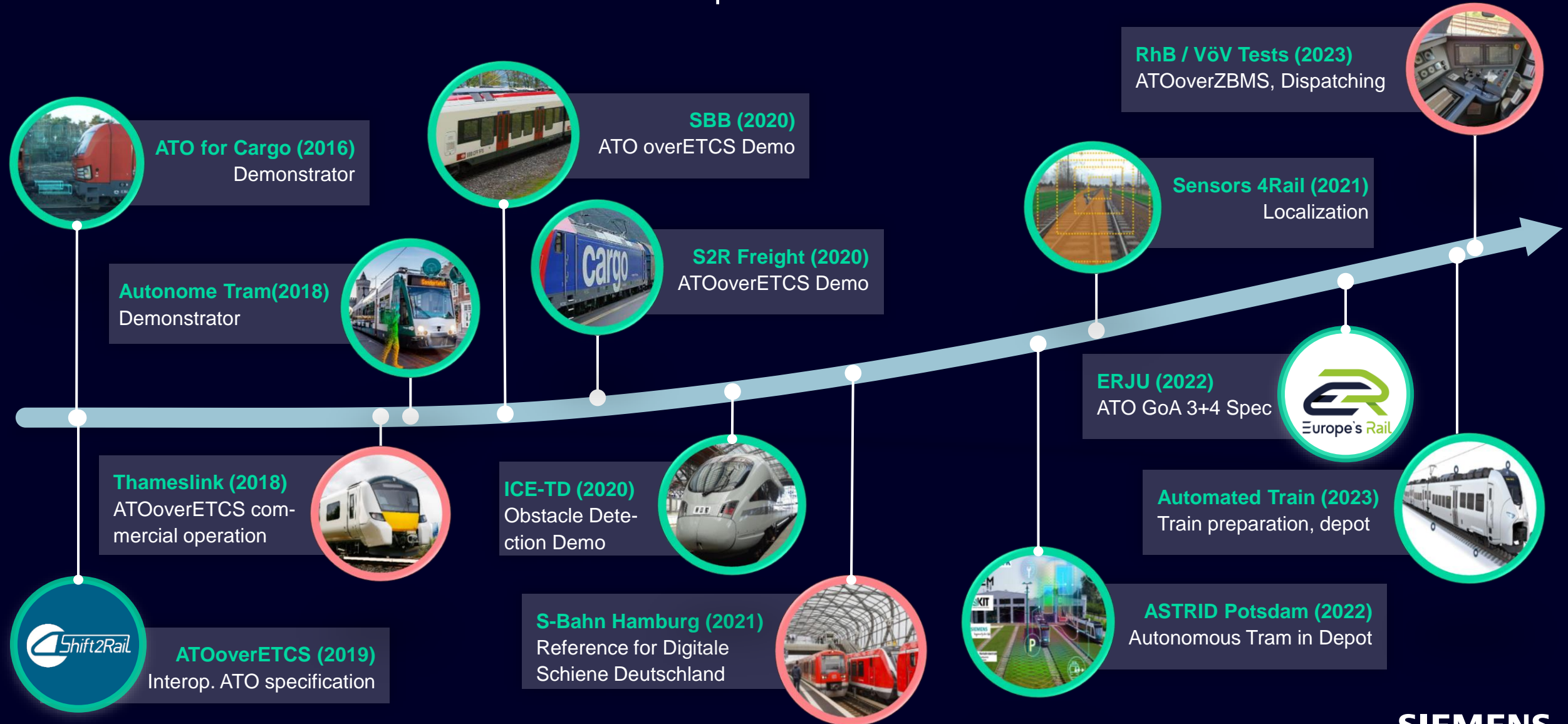
...almost all traffic management subsystems are involved.

...a lot of high quality data is required.

# Reference Projects

# Reference Projects

## Siemens Track Record for Automatic Train Operation



# Reference Projects

## Thameslink (2018)



### Mission

- Closing the north/south gap in London Greater Area rail network aiming at 40M passengers p.a. in mixed traffic
- Target capacity 24 trains/hour and direction during peak hours
- Providing signalling and on-board technology for 115 EMU's
- Optimized GoA2 approach of trains to the Thameslink corridor

#ATOoverETCS

#ETCS

#TMS

#GoA2

#GSM-R

#OCS



# Reference Projects

## Digitale S-Bahn Hamburg (2021)



### Mission

- Increase rail network capacity by reduced headway and GoA2
- Improved timetable stability and on-time performance
- Reduced power consumption by optimal breaking/acceleration timing
- Fully GoA4-enabled shunting and turnaround

#ATOoverETCS

#ETCS

#TMS

#Dispo

#Shunting

#GoA4

#GoA2

#OCS



# Reference Projects

## VöV ATO Testing at Rhätische Bahn (2023)



### Mission

- Seamless integrated technology demonstration from dispatching via operations control, interlocking and train control systems
- Dynamically updated optimal driving instructions considering operational constraints (e.g. occupied tracks, speed restrictions)
- Harvesting timetable reserves and power saving potentials
- ETCS-independent technical implementation

#ATOoverZBMS

#Dispo

#GoA2

#TMS

#OCS



# Conclusion



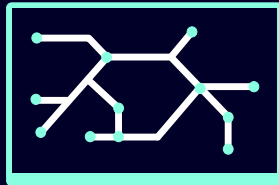
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## Conclusion

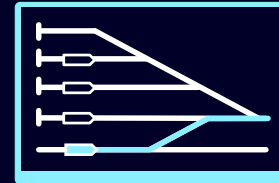
ATO is a key technology to stabilize  
timetable operations.



A powerful traffic management system is  
the cornerstone to maximize network  
capacity using ATO.



ATO can help to enable lean  
operations in shunting and  
yard areas.





**Transform mobility for everyone**