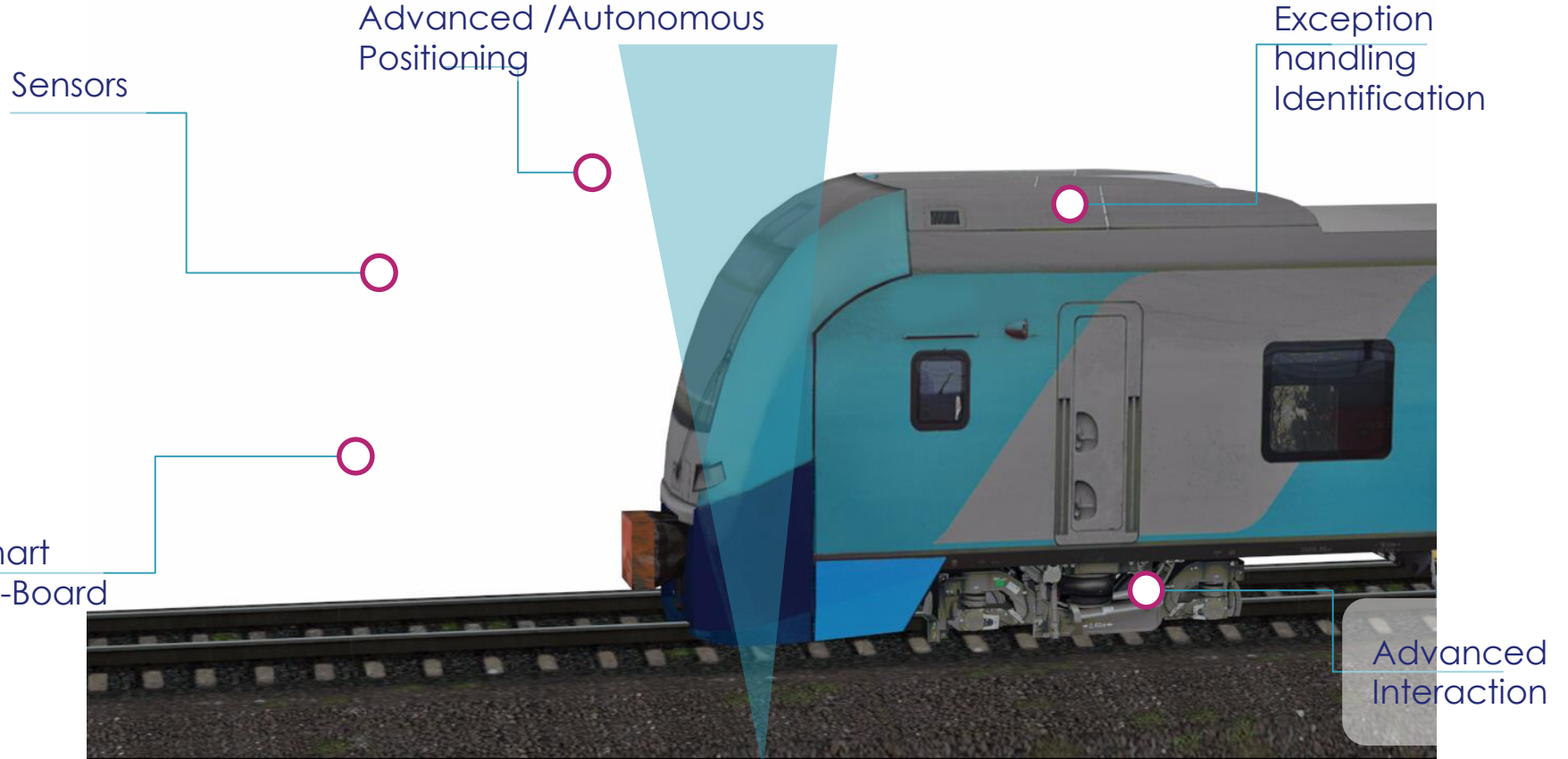


Autonomes Fahren mit ETCS im neuen digitalen und ökonomischen Umfeld

Autonomous driving with
ETCS in new digital and
economy environment



What is an Autonomous Train



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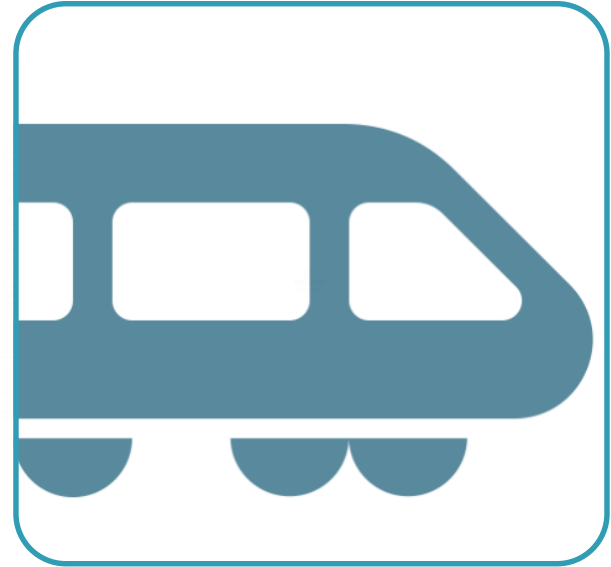
Grade of Automation



GoA2



GoA3



GoA4

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What answer with autonomous trains?

Digitalisation

Down-Time ↓

Safety ↑

Energy Consumption ↓

How ?

Security ↑

Capacity ↑

Flexibility ↑

New Economy

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What the Driver Does Today



Use cases / ETCS L0, L1, L2, L3



ENV. MONITORING



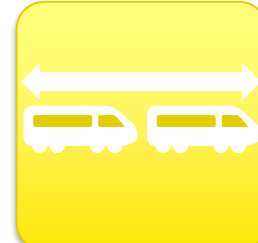
TRAIN WAKEUP



MISSION CONTROL



TRACK WORK



TRAIN INTEGRITY



SUICIDE AVOIDANCE



DANGER AVOIDANCE



TRAIN POSITIONING



TRAIN COUPLING



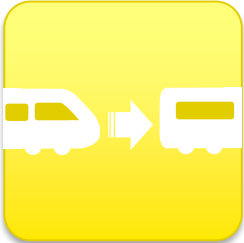
VIRTUAL COUPLING



AUTO TURN BACK



REMOTE CONTROL



ZERO HEADWAY



SIGNAL DETECTION



DEPOT OPERATION



OBSTACLE DETECTION



AUTO LOADING



REPATRIATION

Autonomous train is not only on trains



MISSION CONTROL

Train Orchestration



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Cyber security is must in future

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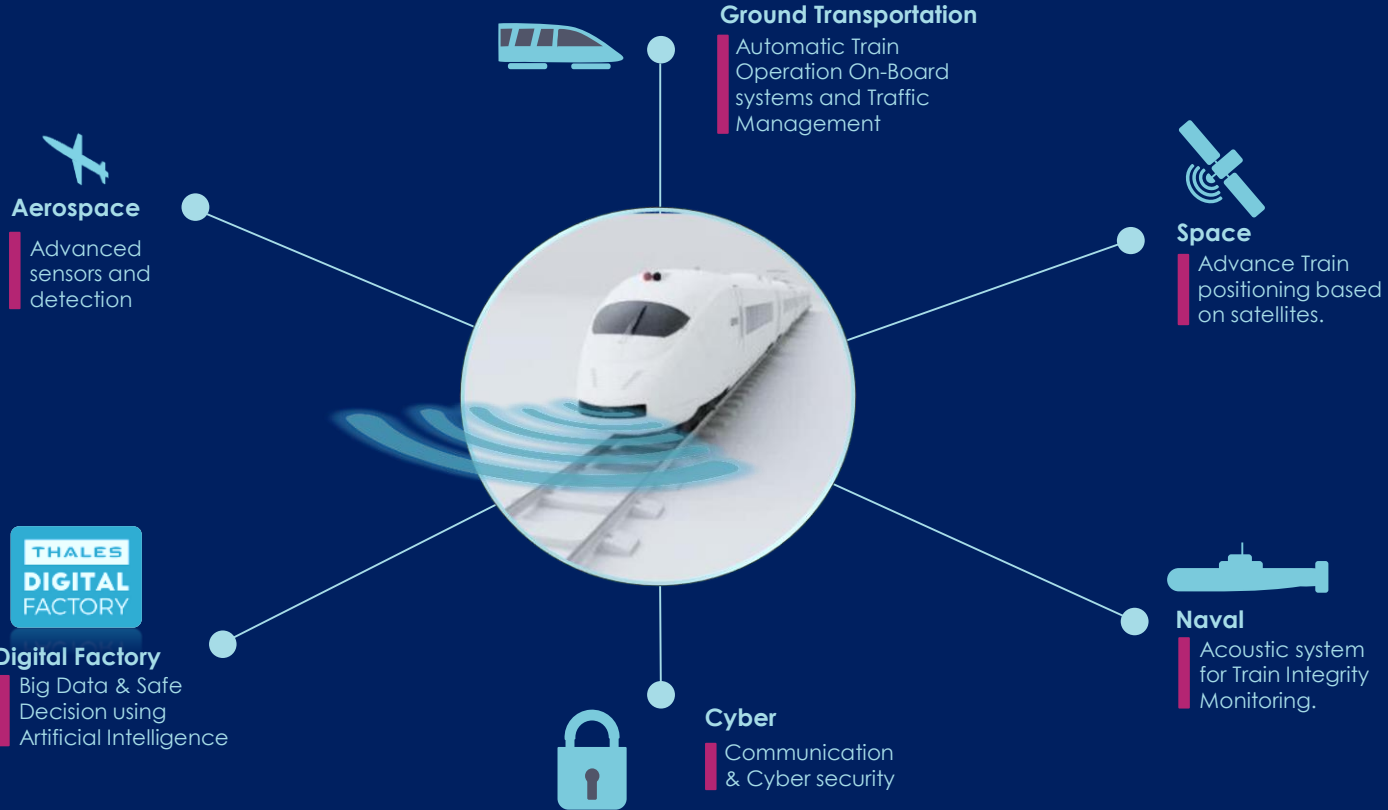


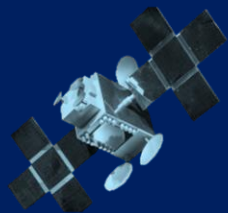
Thales solution

www.thalesgroup.com



Pivoting and leveraging Thales Group Assets





SATELLITE



BIG DATA



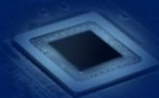
COMMUNICATION



CYBER SECURITY



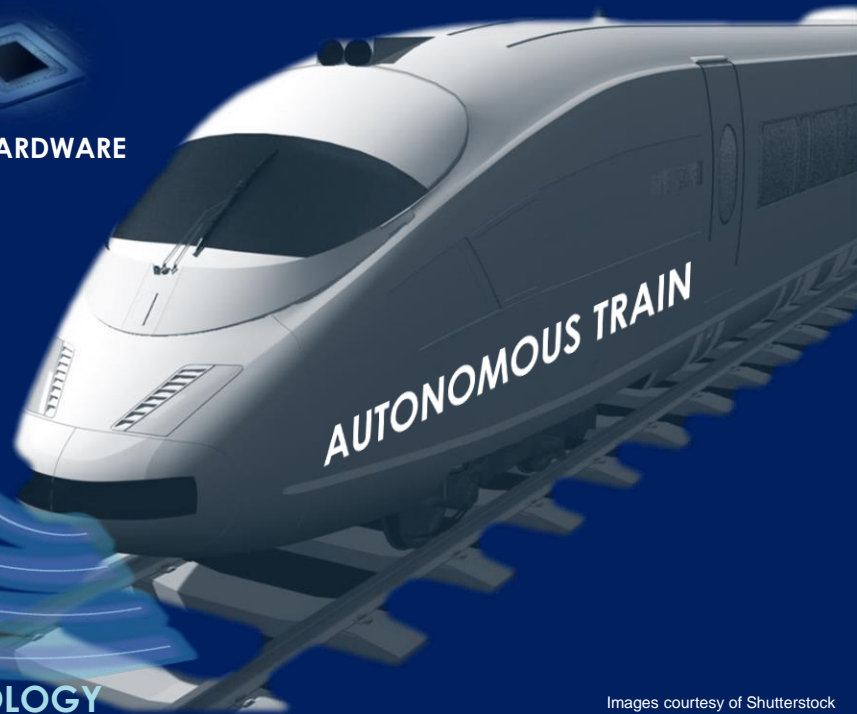
ADVANCE SENSORS



SAFE HARDWARE



SAFE SOFTWARE



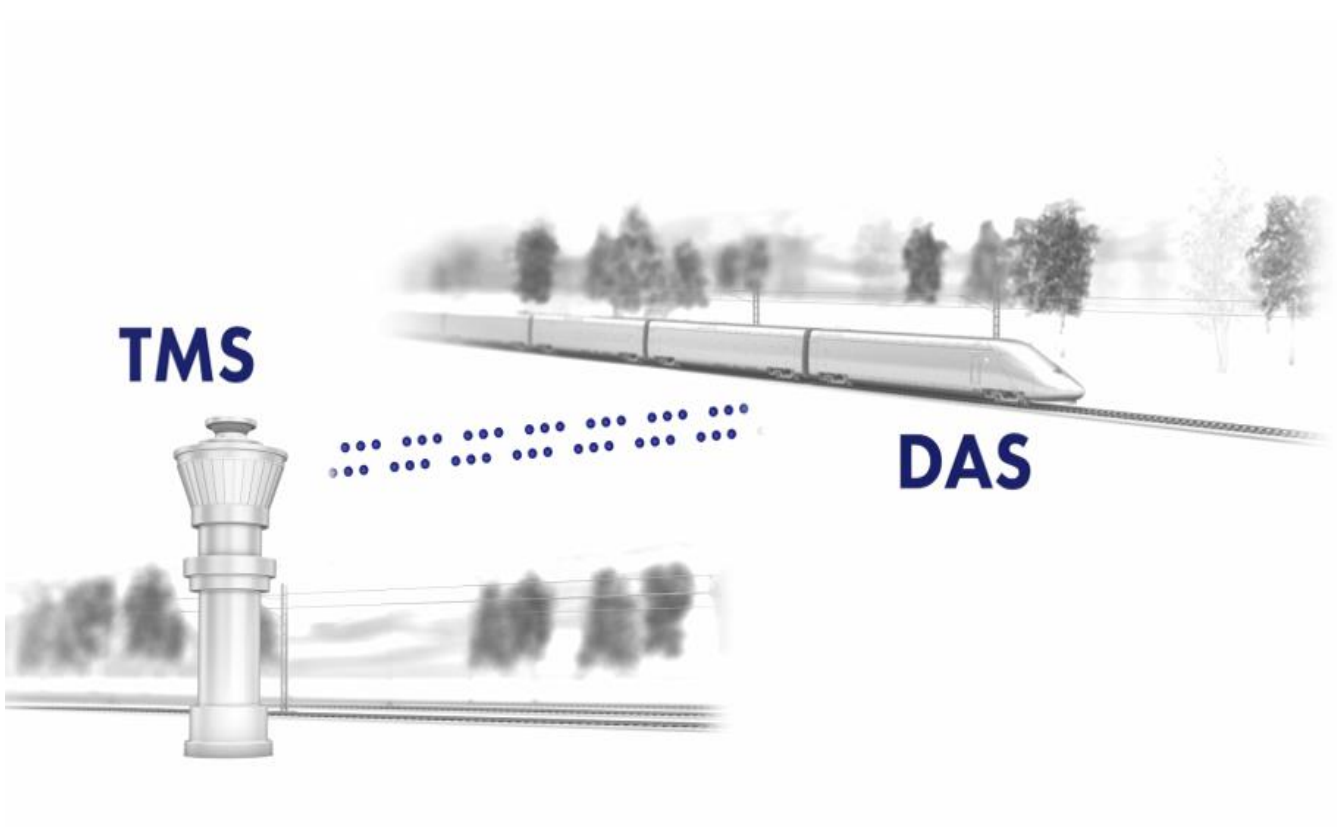
AUTONOMOUS TRAIN



ARTIFICIAL INTELLIGENCE

RAIL AND TECHNOLOGY

C-DAS product video



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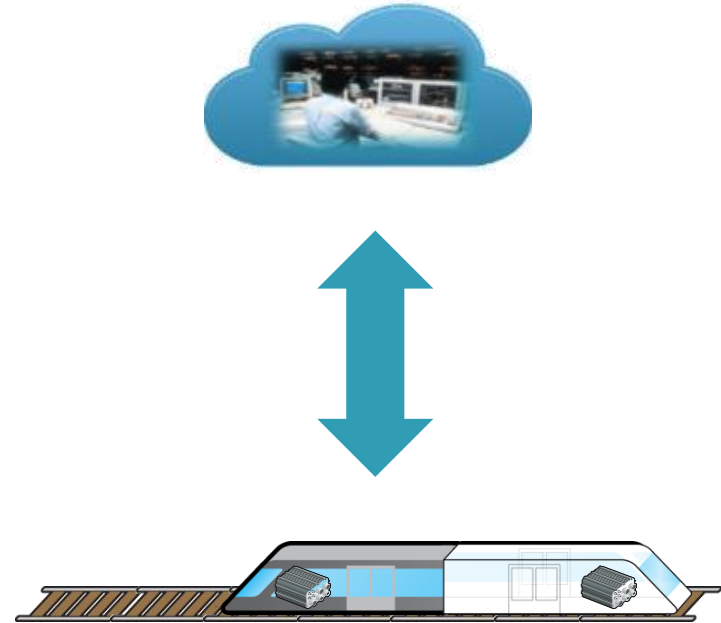
TMS & C-DAS: what does it bring?

C-DAS + TMS closes the loop

- The planning and re-planning of the TMS is conveyed in real time to the C-DAS, letting the driver know the new plan
- The C-DAS guides the driver to execute the always updated plan from the TMS

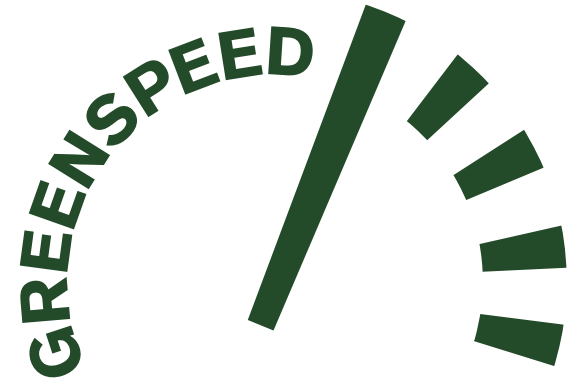
Benefits

- Higher capacity
- Higher punctuality
- Energy savings,
- More fluent traffic (even when conflicts and changes occur)
- Reduced disturbance impact and delays



Green Speed: Proven C-DAS Technology

- Installed across northern Europe
- C-DAS usually offer savings between 10 and 20% of traction energy depending on the type of operation and baseline performance
- C-DAS provides simple advice to the driver based on a range of advanced driving strategies, resulting in energy savings thanks to more efficient driving performance
- C-DAS system is also capable of reporting driving performance and adherence to time table, allowing train operating companies to not only continuously improve but also document their achievements



Scalable C-DAS platform



Installed

- ✓ Highest reliability
- ✓ On-train integrations possible



Tablet

- ✓ Low investment
- ✓ Short implementation time



Plug-in

- ✓ Integrate into existing application or display
- ✓ **ETCS DMI compatible**



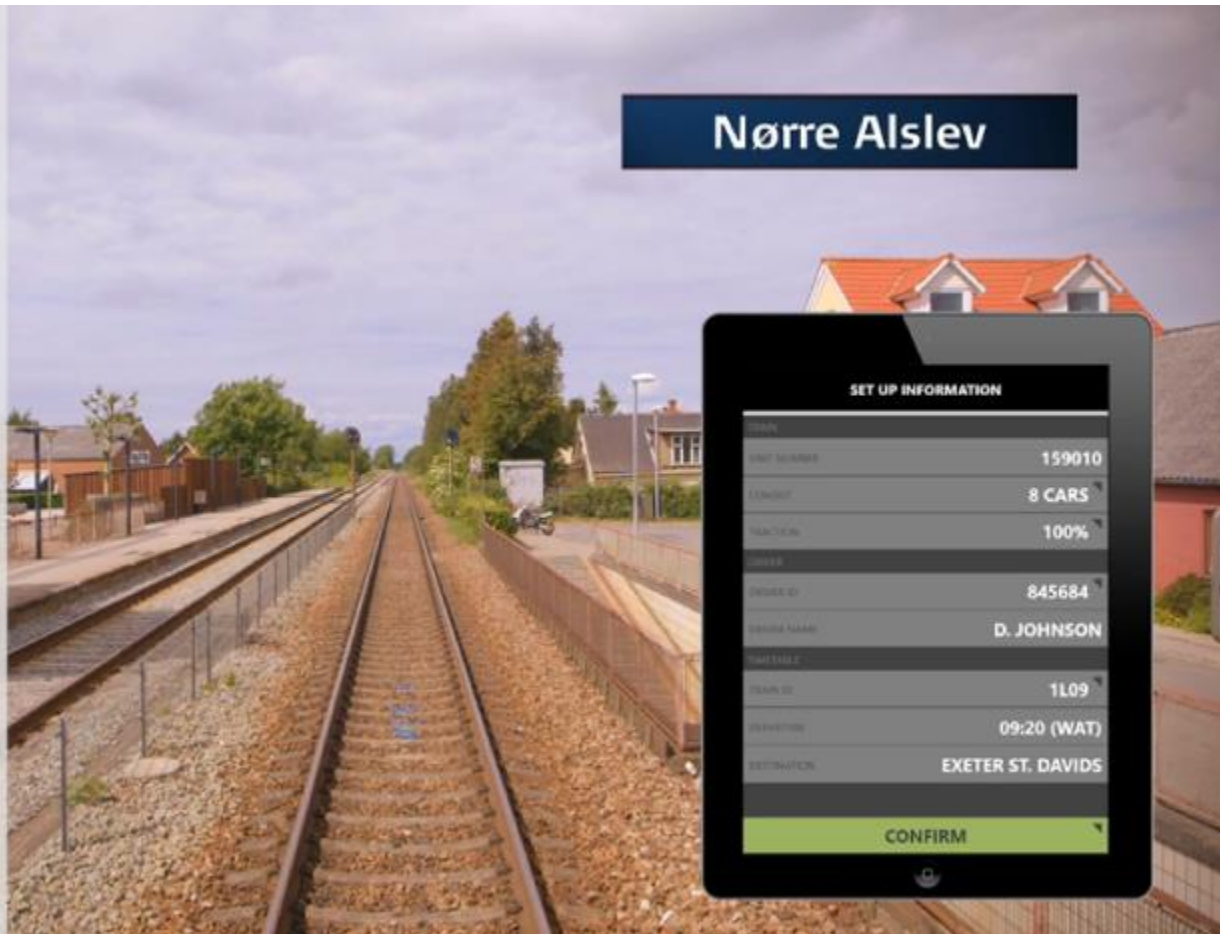
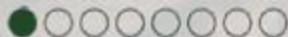
DRIVER ADVISORY SYSTEM

GREENSPEED

GreenSpeed helps the driver to make smart decisions every day in every situation.

GREENSPEED

Mit GreenSpeed treffen Fahrer intelligente Entscheidungen – jeden Tag, in jeder Situation.



Nørre Alslev

SET UP INFORMATION

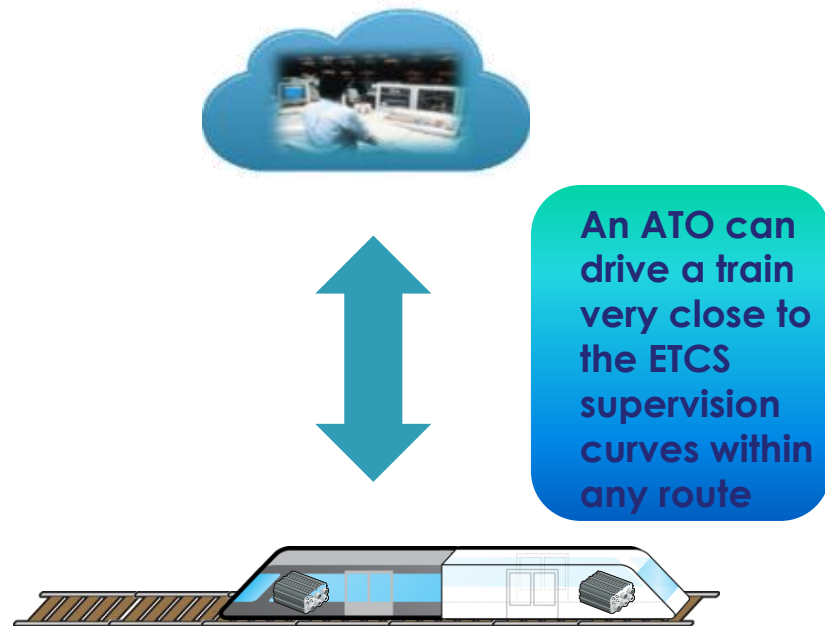
TRAIN	
UNIT NUMBER	159010
LENGTH	8 CARS
TRAIN TYPE	100%
DRIVER	
DRIVER ID	845684
DRIVER NAME	D. JOHNSON
TRAIN DATE	
TRAIN NO	1L09
DEPARTURE	09:20 (WAT)
DESTINATION	EXETER ST. DAVIDS

CONFIRM

TMS & ATO: what does it bring?

Benefits

- higher punctuality
- Higher operational performance
- Even higher energy savings
- Improves stability of operation
- limits the propagation of perturbation
- provides faster recovery from disturbance
- Reduce staff cost
- reduce the mechanical wear on both trains and track, thereby reducing maintenance costs
- Automatic depot operations



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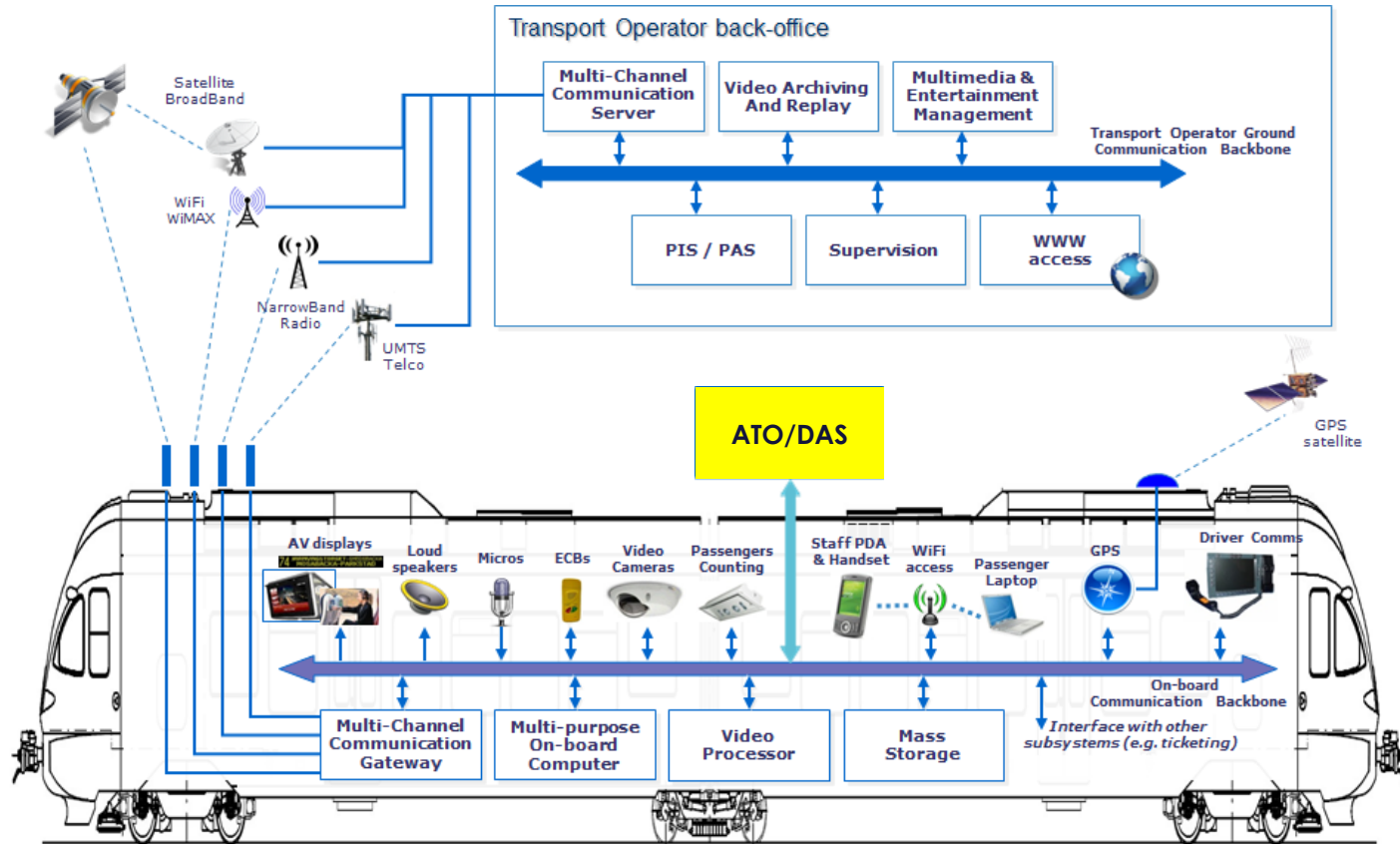


Digitalisation

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Digitalisation means: ATO @ OBIF - Overall On Board Architecture



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Customer Projects ongoing

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Customer Projects



TCRail: Remote control of the train



SNCF Train Autonome GoA4



**ATO
On-Board**



TRAIN POSITIONING



OBSTACLE DETECTION



**SIGNAL
DETECTION**



**REMOTE
CONTROL**



**MISSION
CONTROL**



**TRAIN
INTEGRITY**



**DEPOT
OPERATION**



OBSTACLE DETECTION

**“ETCS L2 plus (ETCS L3)”
support:**

Higher capacity on track