



DUBAI WORLD CONGRESS
FOR SELF-DRIVING TRANSPORT

OCT | 2019

Autonomous trains

Dr. Amine AREZKI

Head of Autonomy, **Thales Group**

www.sdcongress.com



THALES

Autonomous Trains



Why autonomous trains?

Punctuality ↑

Safety ↑

Passenger Comfort ↑

Energy savings ↓

WHY?

Security ↑

Economy ↑

Capacity ↑

Flexibility ↑

HOW ?

**IMPROVING SAFETY
& SECURITY**

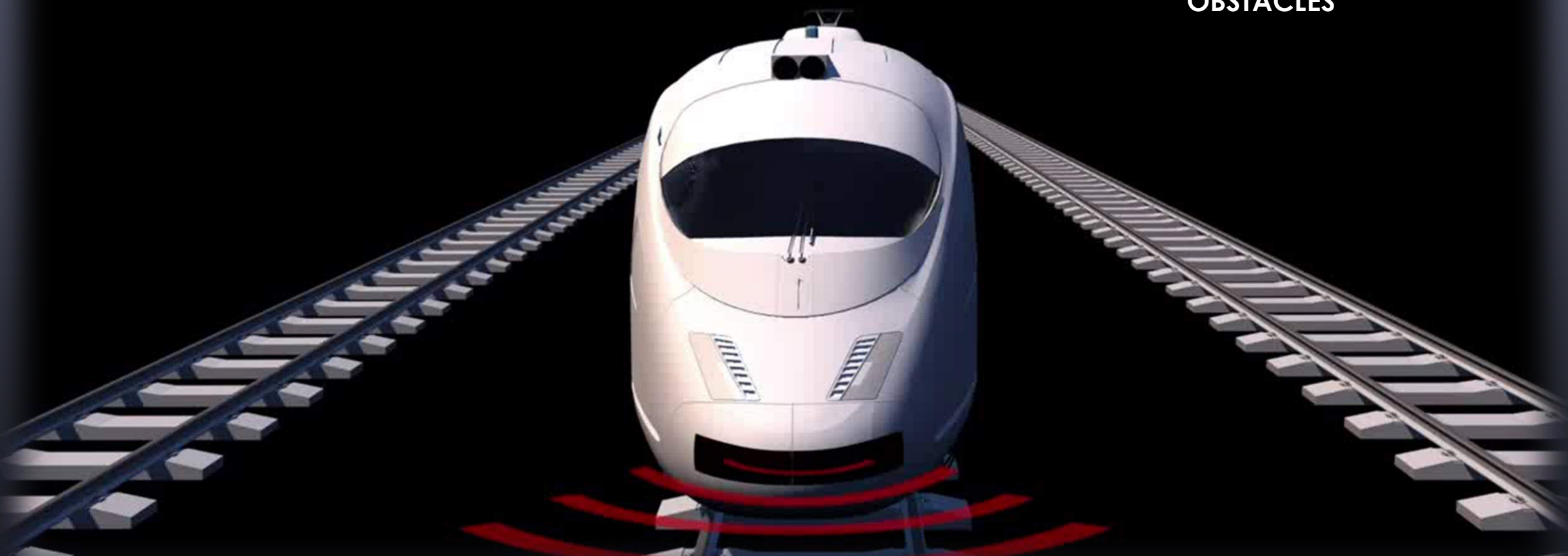
**ABILITY TO TAKE
QUICK DECISIONS**

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HOW ?

**IMPROVING SAFETY
& SECURITY**

**AVOIDING
OBSTACLES**



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HOW ?

**IMPROVING
PUNCTUALITY**

ANTICIPATION



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HOW ?

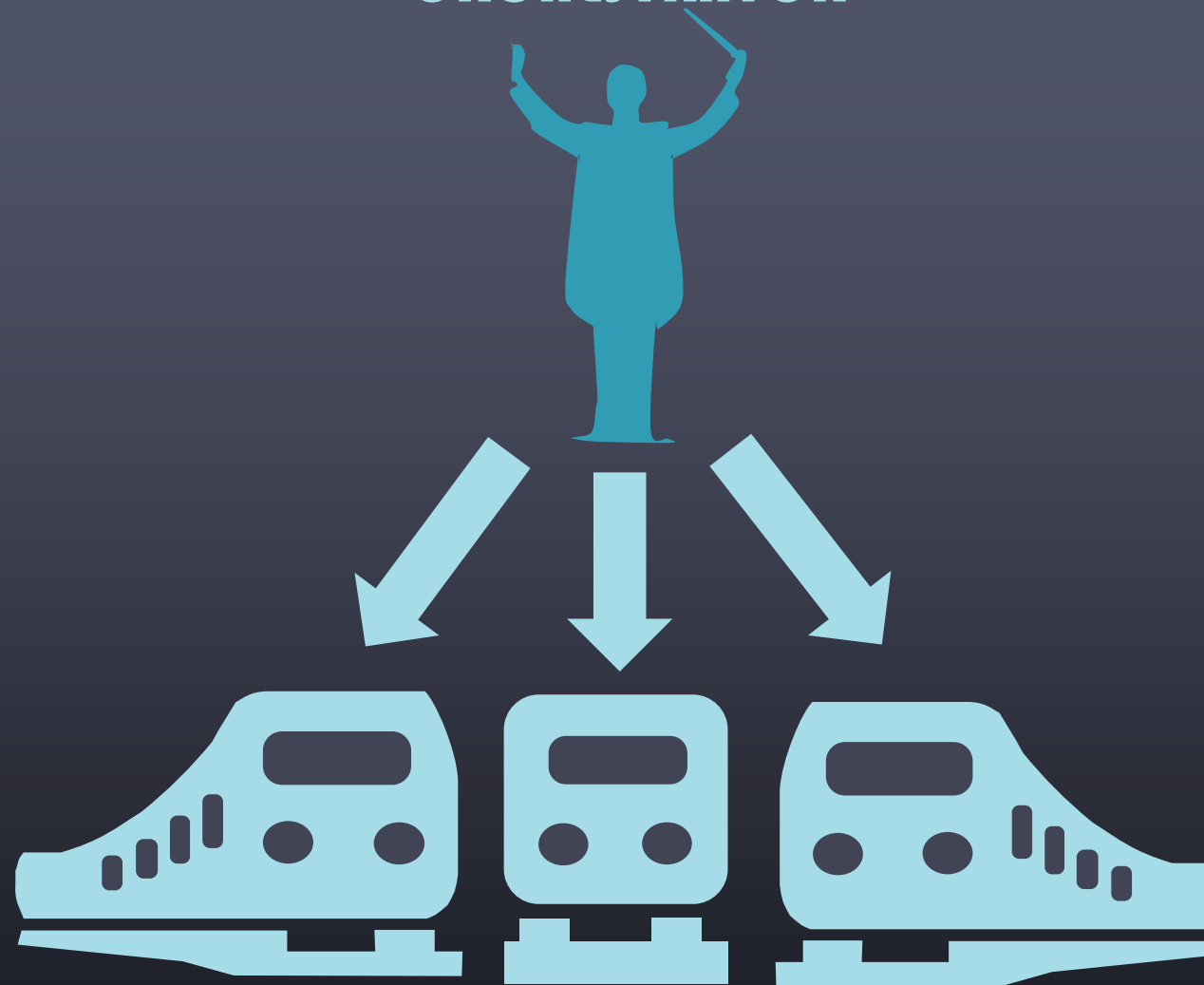
FLEXIBILITY

**ORCHESTRATION
AND QUICK
RECOVERY**



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ORCHESTRATOR



What is an Autonomous Train ?

Advanced
Positioning

AI

Sensors

Smart on-
Board

Advanced
Interaction



Grade of Automation



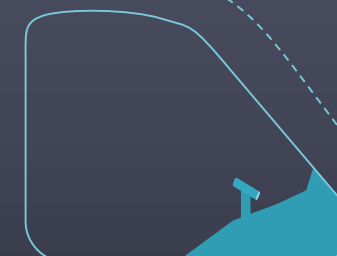
GoA1



GoA1



GoA3



GoA4

Autonomy does not replace a driver but a certain task

Autonomy Use-Cases Highlights



ENV. MONITORING



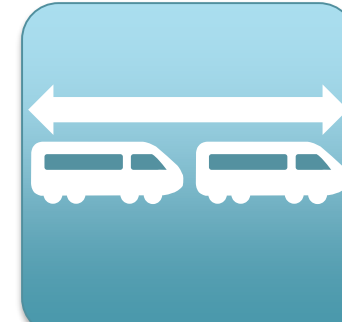
TRAIN WAKEUP



MISSION CONTROL



TRACK WORK



TRAIN INTEGRITY



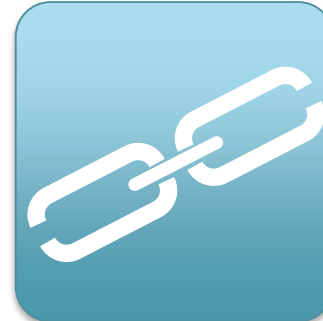
SUICIDE AVOIDANCE



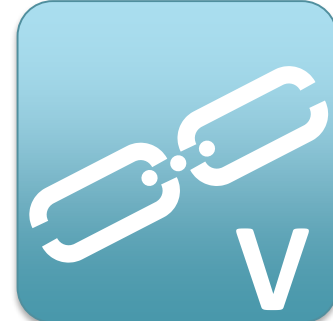
DANGER AVOIDANCE



TRAIN POSITIONING



TRAIN COUPLING



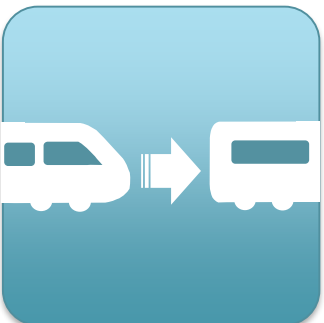
VIRTUAL COUPLING



AUTO TURN BACK



REMOTE CONTROL



ZERO HEADWAY



SIGNAL DETECTION



DEPOT OPERATION



OBSTACLE DETECTION



AUTO LOADING



REPATRIATION

Autonomy Use-Cases Highlights



ENV. MONITORING



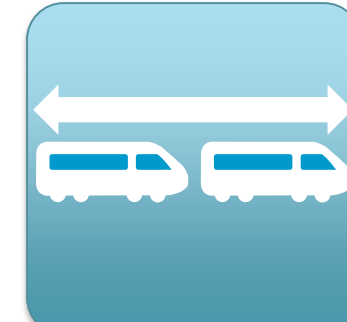
TRAIN WAKEUP



MISSION CONTROL



TRACK WORK



TRAIN INTEGRITY



SUICIDE AVOIDANCE



DANGER AVOIDANCE



TRAIN POSITIONING



TRAIN COUPLING



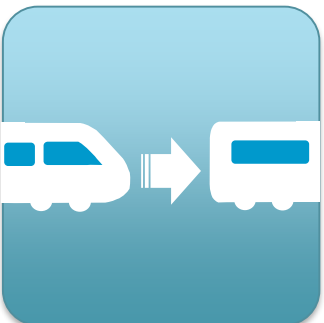
VIRTUAL COUPLING



AUTO TURN BACK



REMOTE CONTROL



ZERO HEADWAY



SIGNAL DETECTION



DEPOT OPERATION



OBSTACLE DETECTION



AUTO LOADING



REPATRIATION

Train Wake-UP



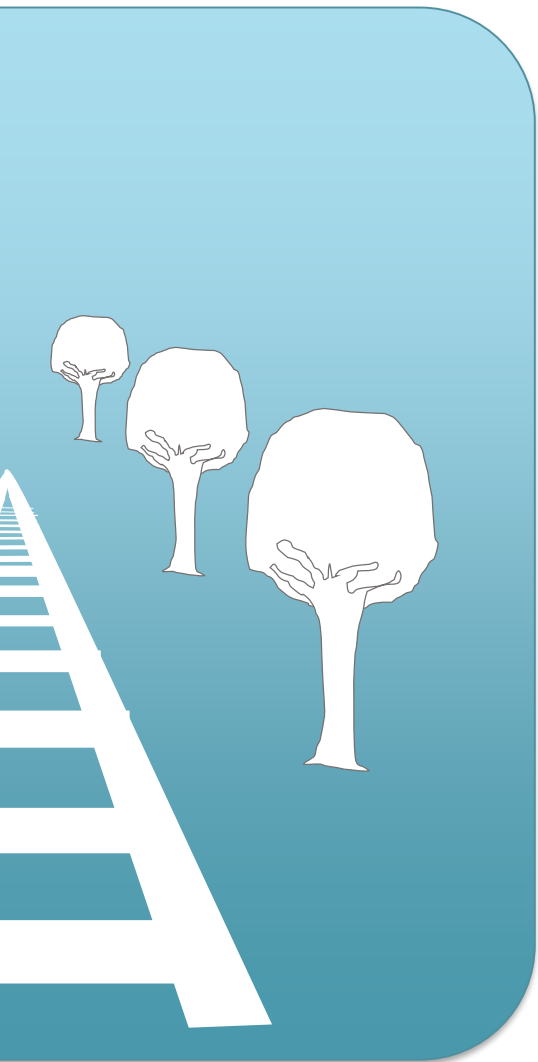
TRAIN WAKEUP

Start-Up



Train Test





MONITORING

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Information Classification: General



TRAIN WAKEUP



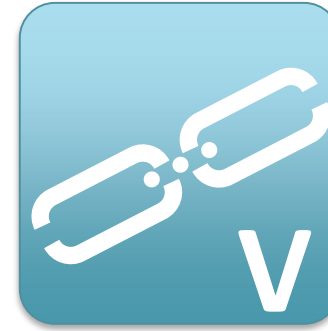
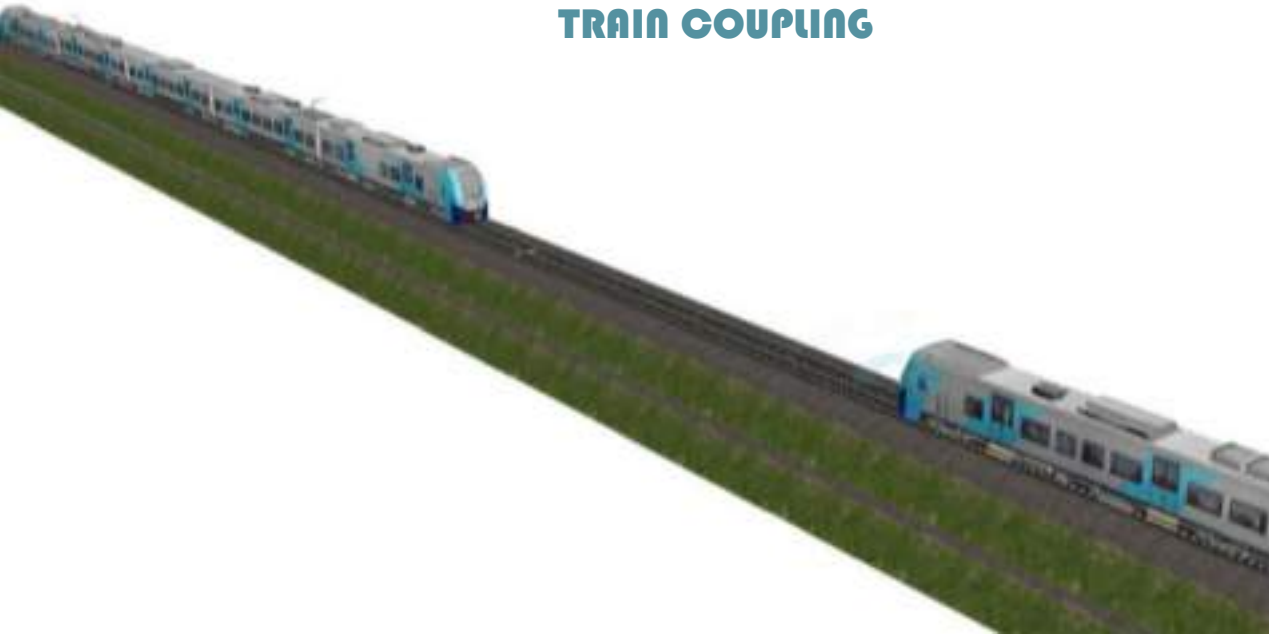
MISSION

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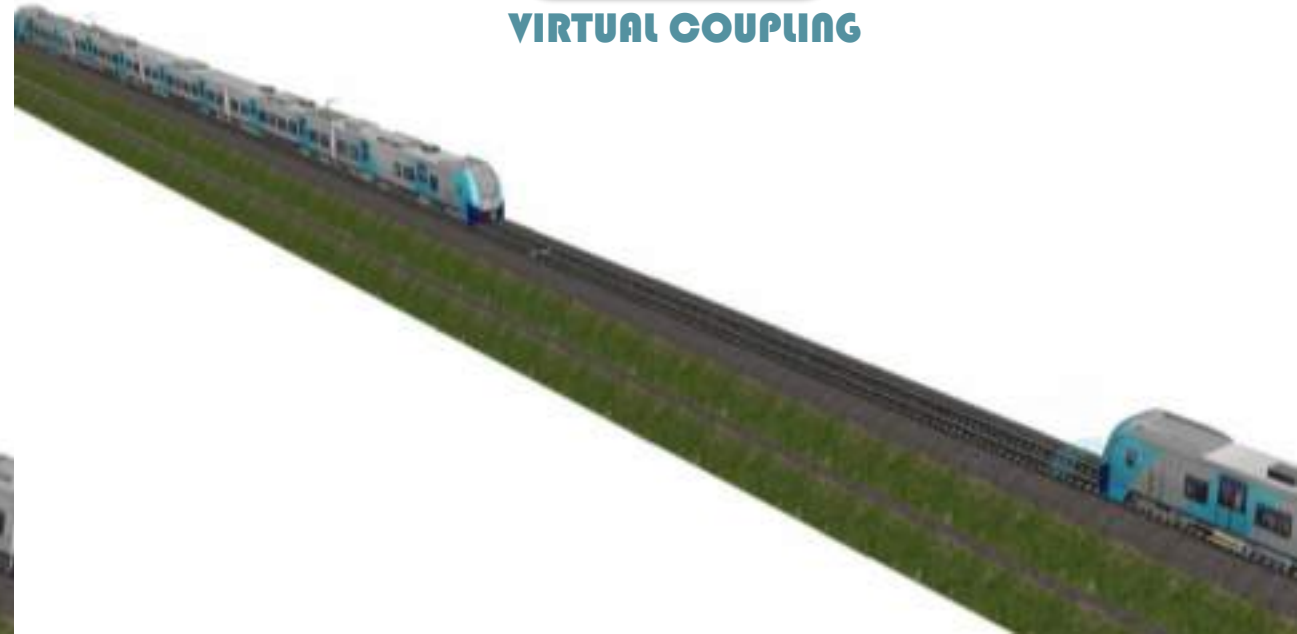
Train Coupling

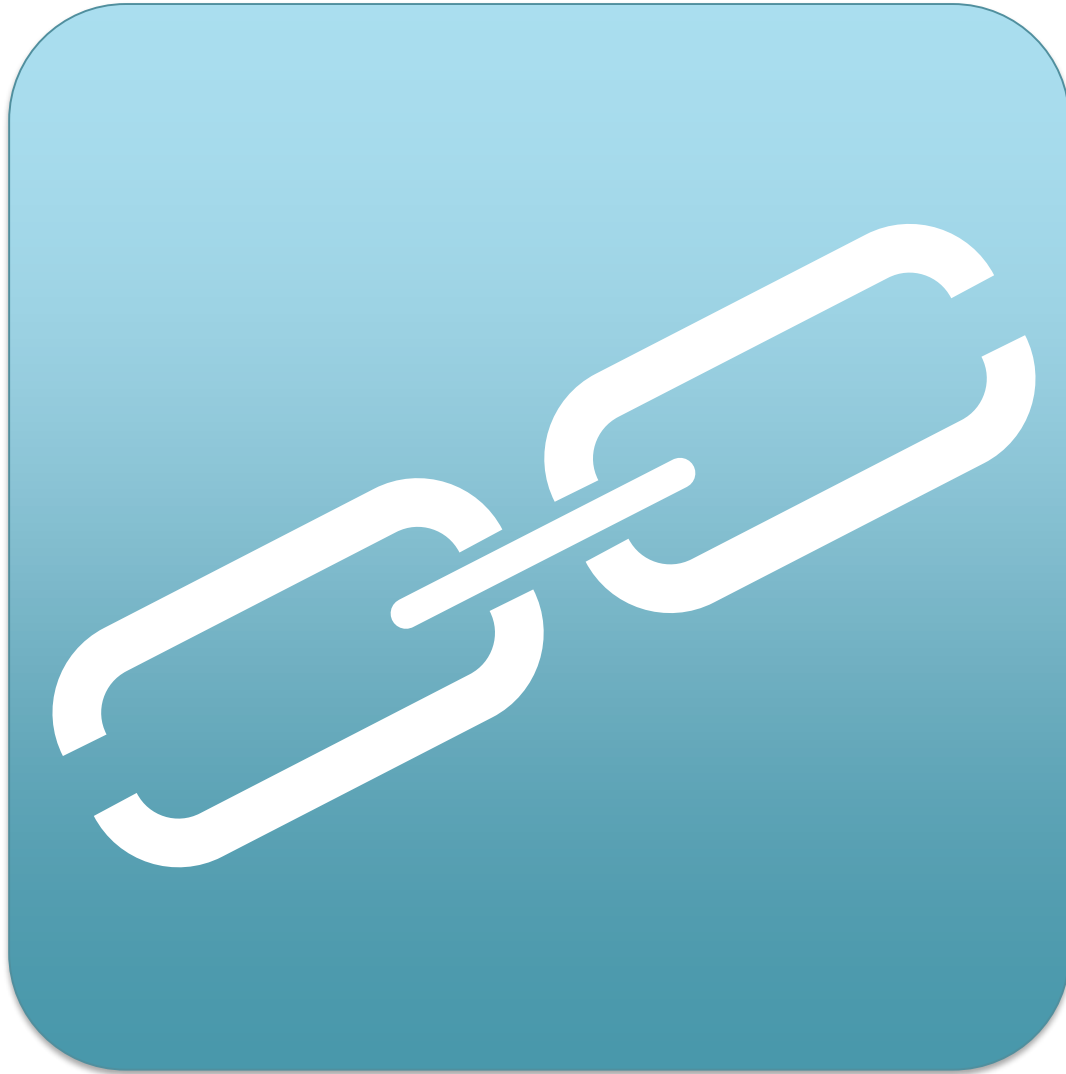


TRAIN COUPLING

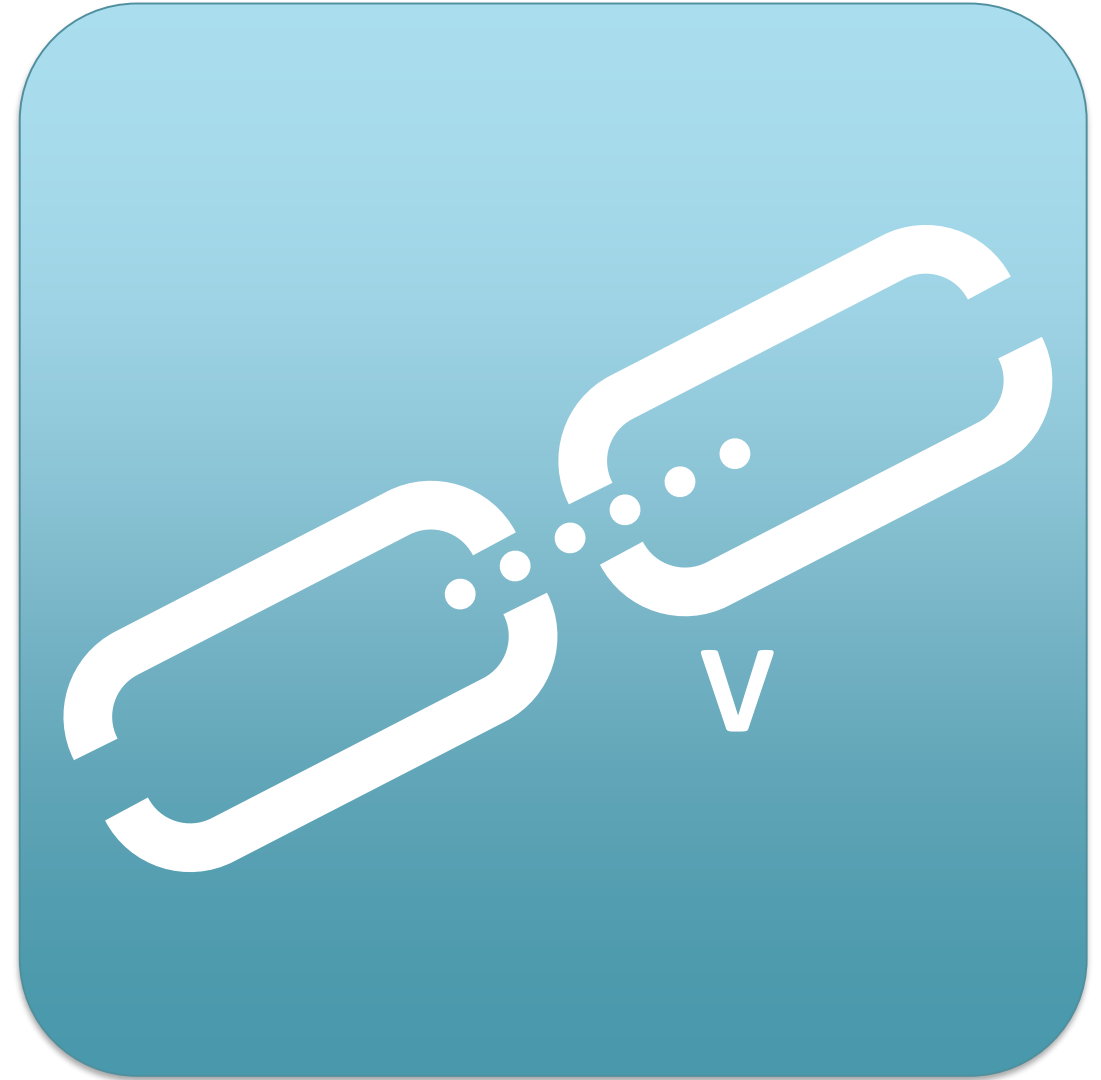


VIRTUAL COUPLING





TRAIN COUPLING



VIRTUAL COUPLING

Reaction According to Pedestrian Behavior



SUICIDE AVOIDANCE





RITY

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SUICIDE AVOIDANCE

REMOTE CONTROL : Degraded Modes



REMOTE CONTROL





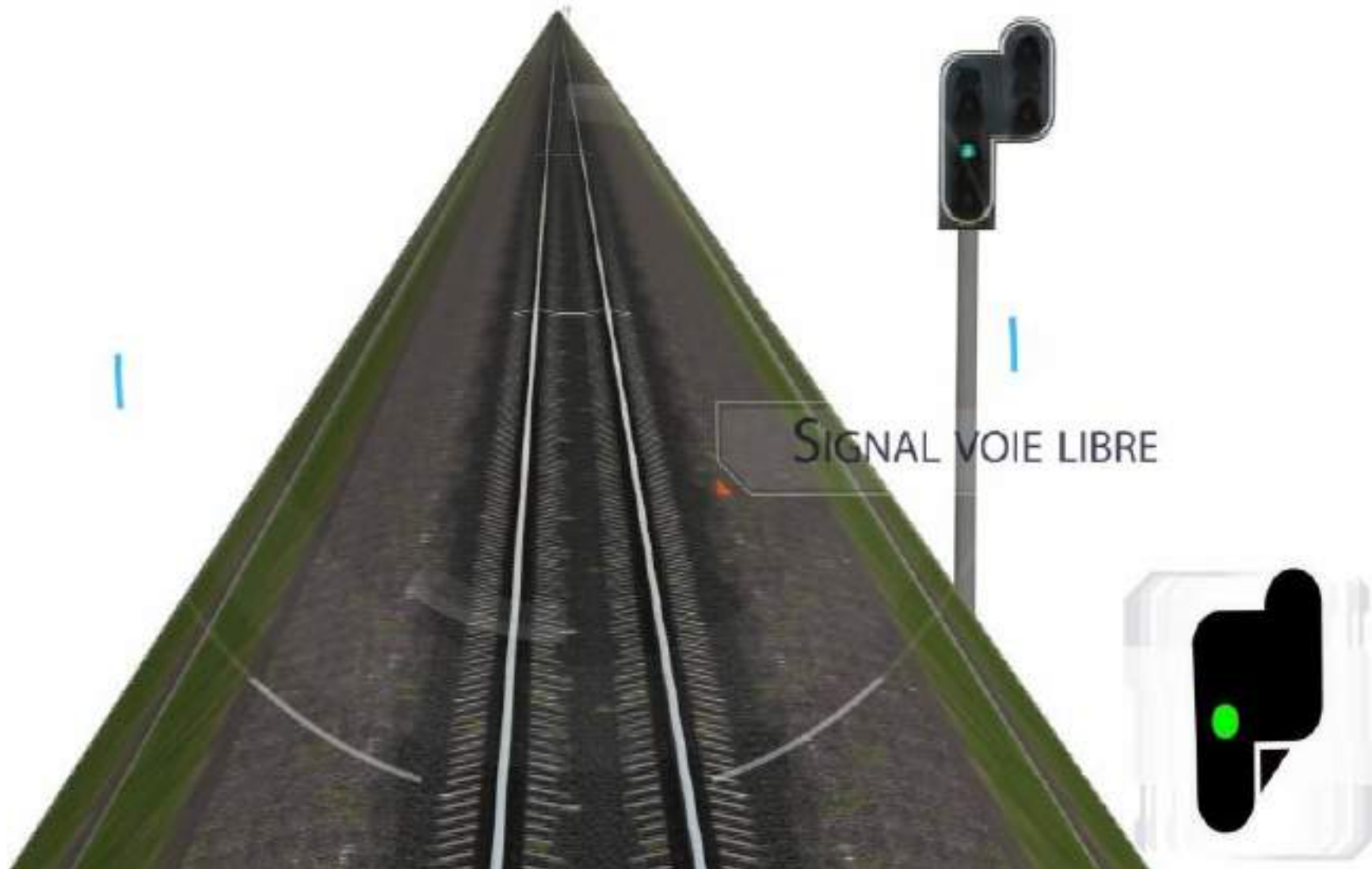
BACK

REMOTE CONTROL

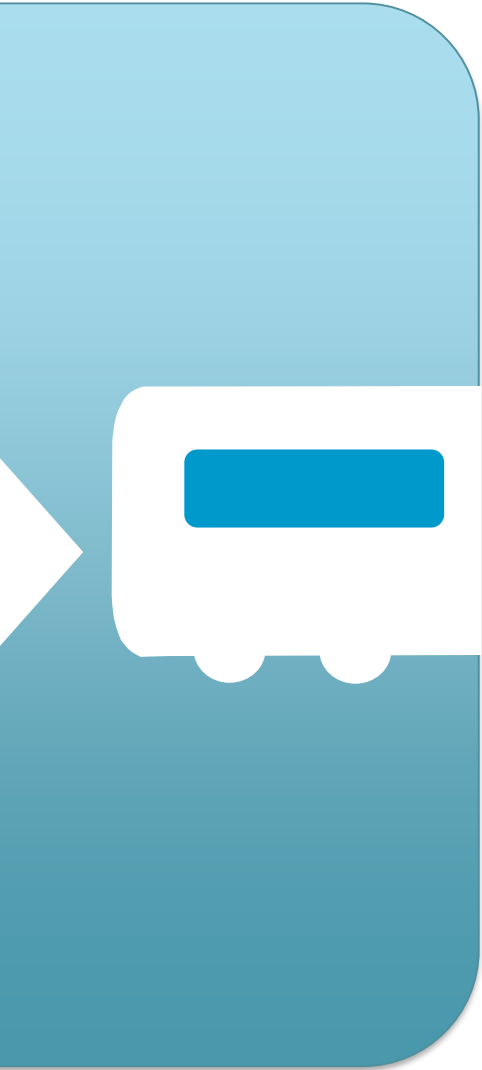
Signal Detection



SIGNAL DETECTION



Use cases



LEADWAY

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SIGNAL DETECTION

DEPOT

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Security of Passenger



DANGER AVOIDANCE



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Traffic Management + ATO Track Side

Digital Services

Train Positioning
(Satellite & Sensors)

Remote Control

Signal Reader
(Camera)

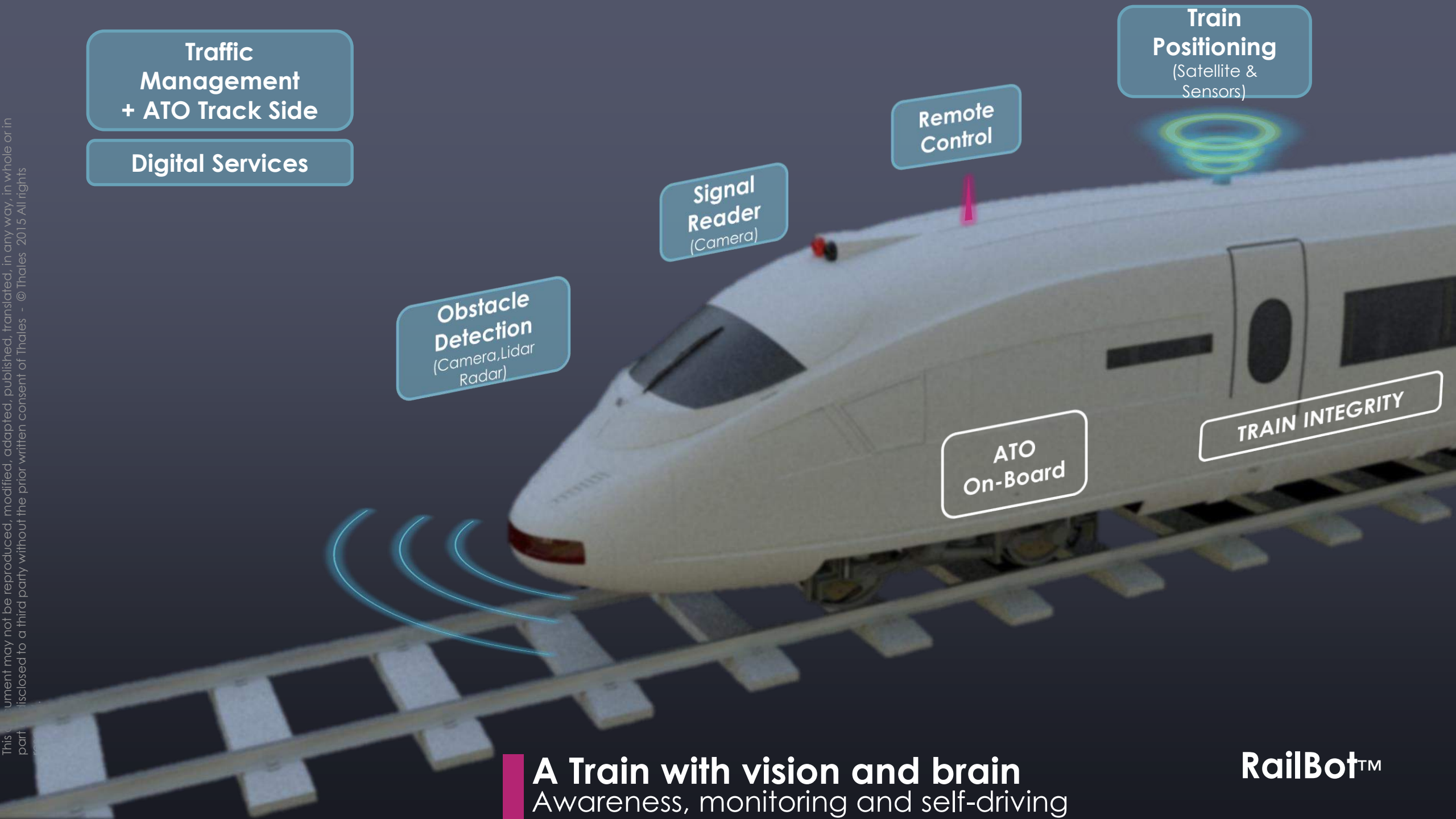
Obstacle Detection
(Camera, Lidar Radar)

ATO On-Board

TRAIN INTEGRITY

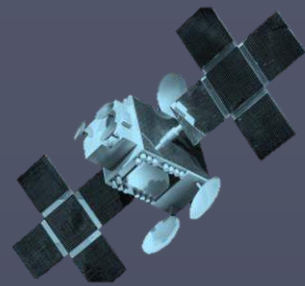
A Train with vision and brain
Awareness, monitoring and self-driving

RailBot™

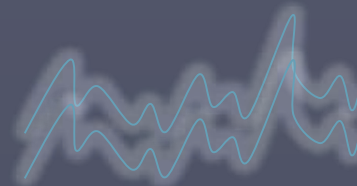


AUTOMATIC vs AUTONOMOUS





SATELLITE



BIG DATA



COMMUNICATION



CYBER SECURITY



SAFE HARDWARE



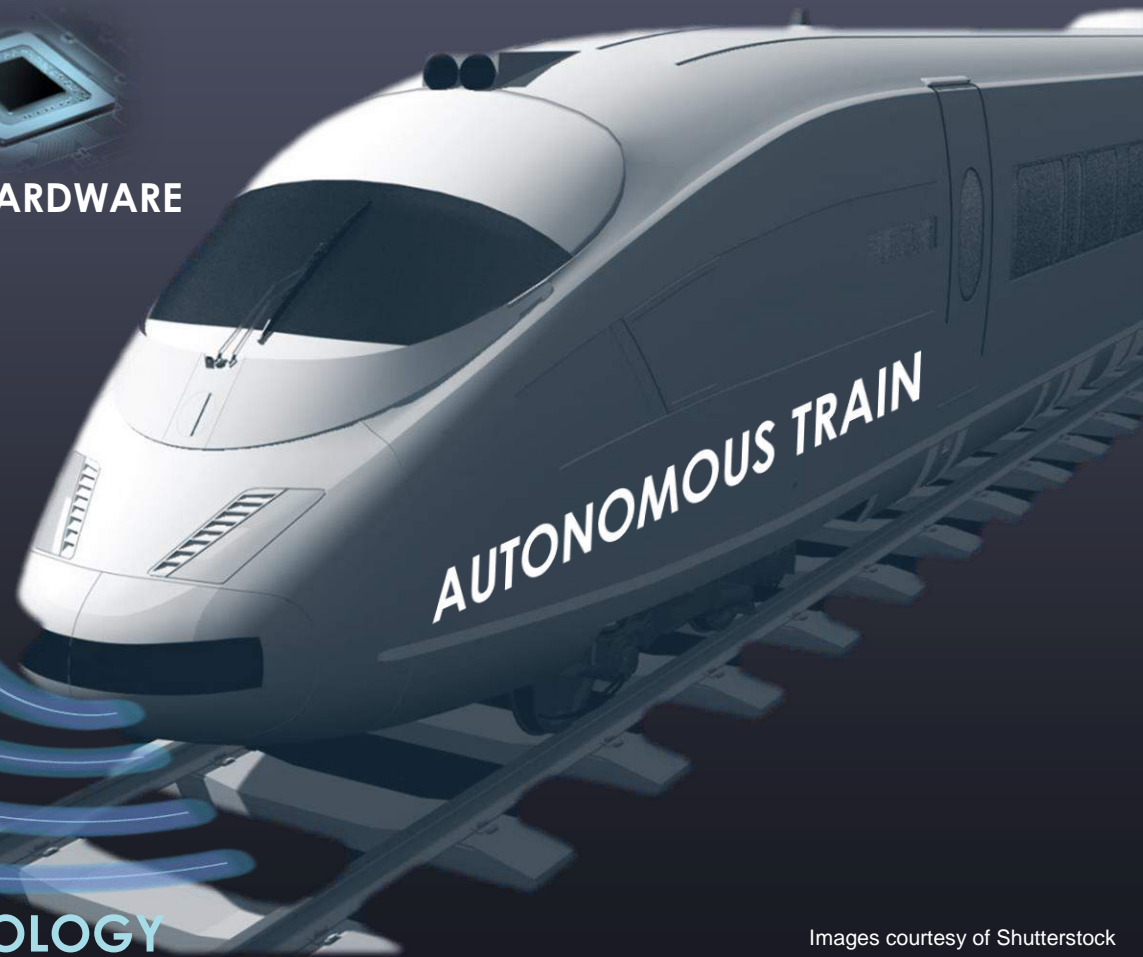
ADVANCE SENSORS



SAFE SOFTWARE



ARTIFICIAL INTELLIGENCE

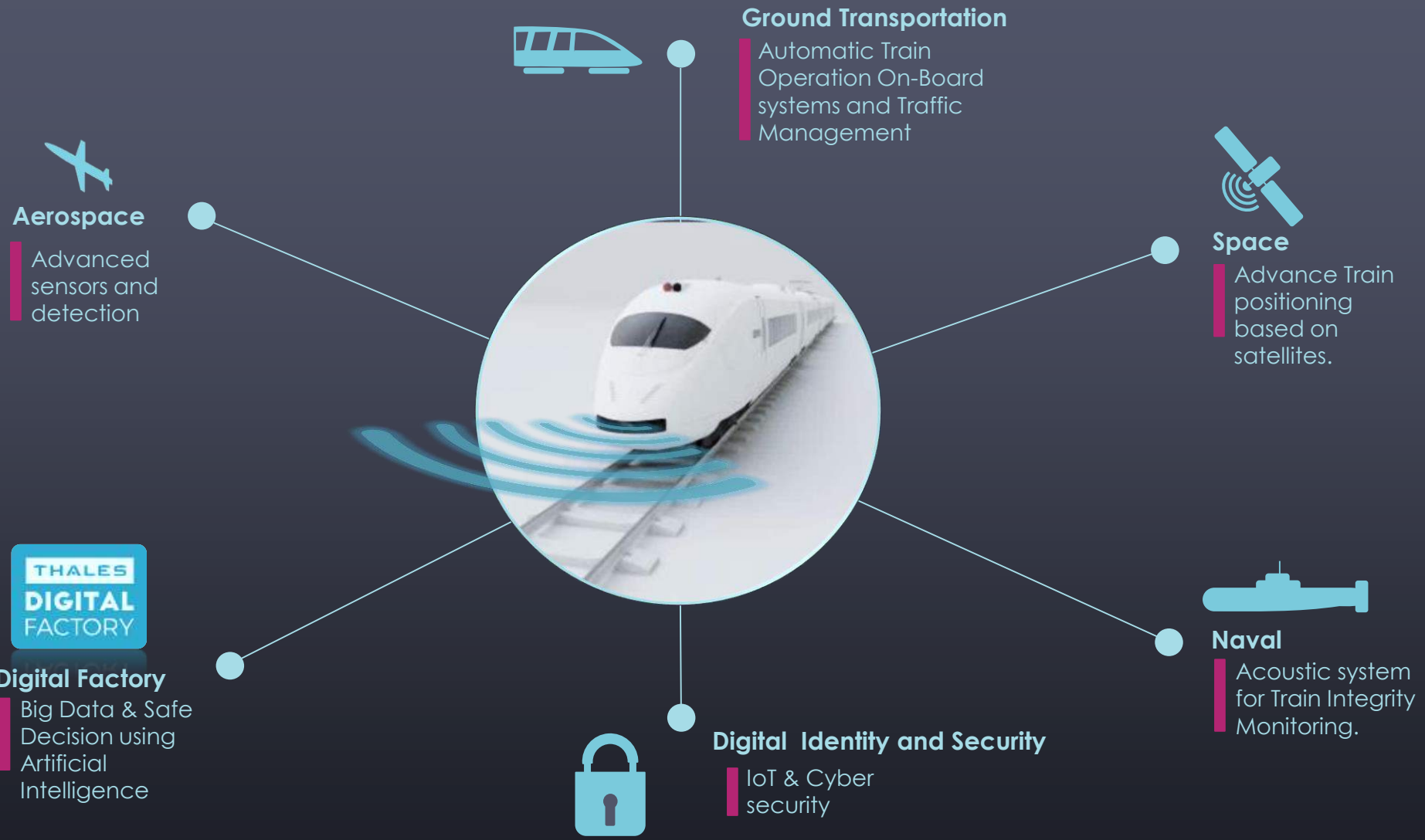


AUTONOMOUS TRAIN

RAIL AND TECHNOLOGY

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Pivoting and leveraging Thales Group Assets

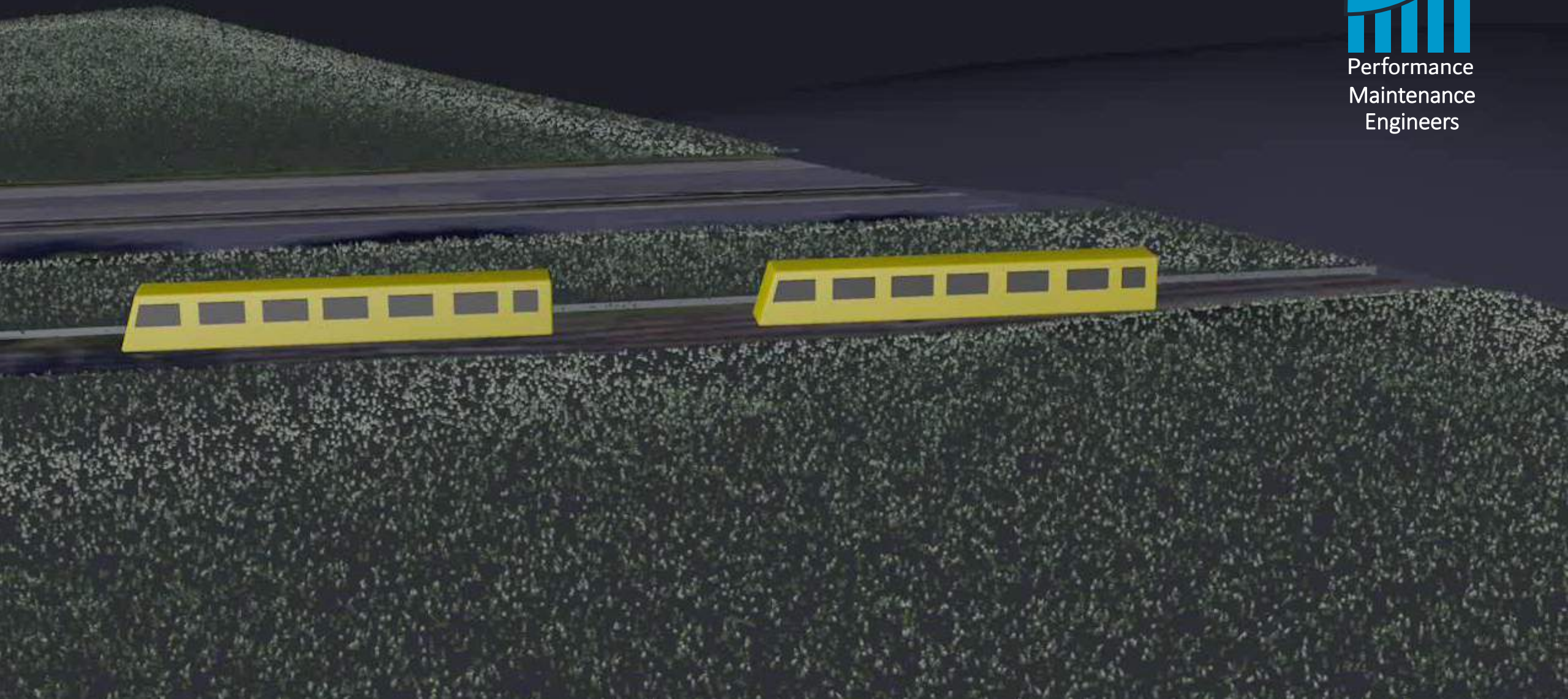


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Train Drivers





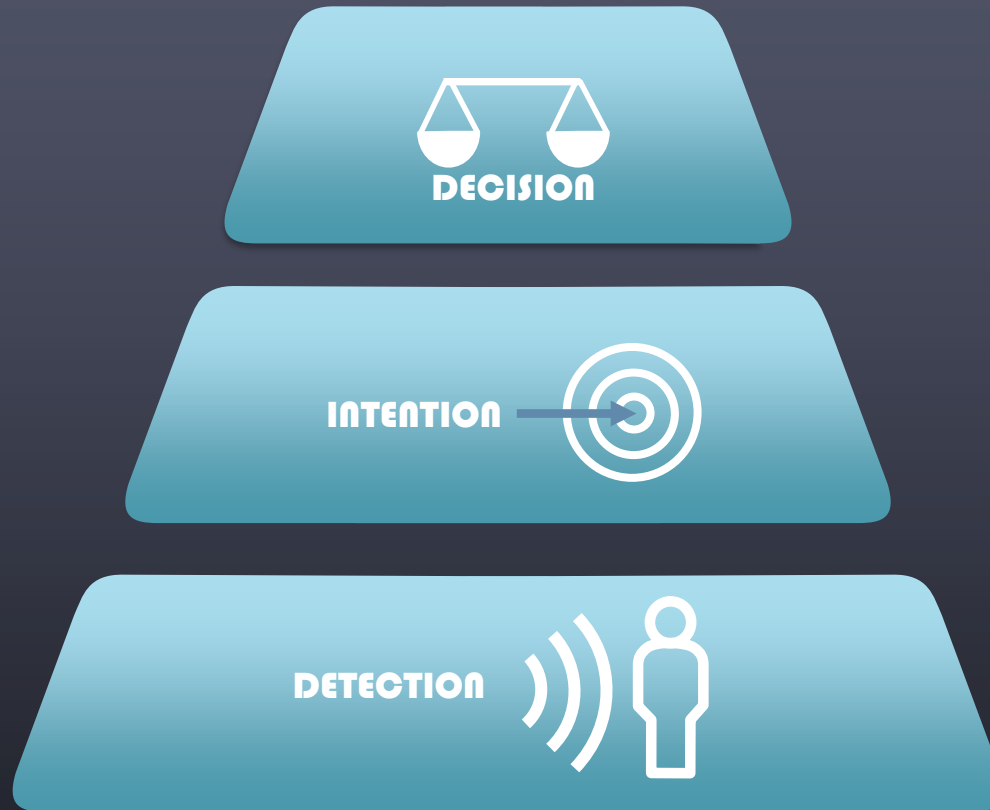
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Obstacle Detection

Train Vision



Levels of AI

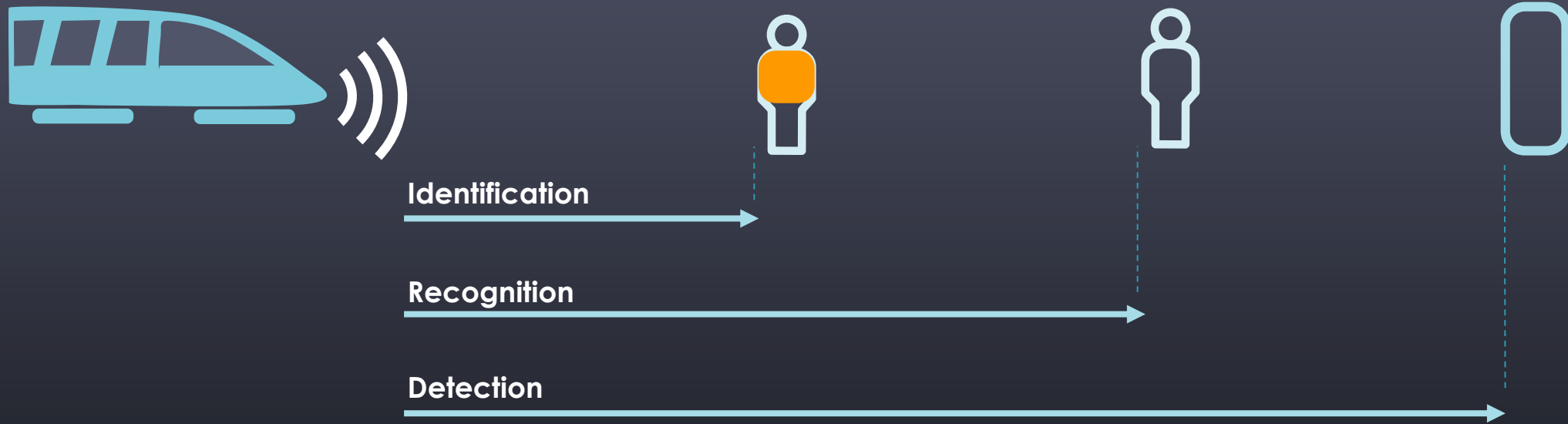


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Obstacle Detection



DETECTION



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Fishes crossing the road! (Seattle, Washington)

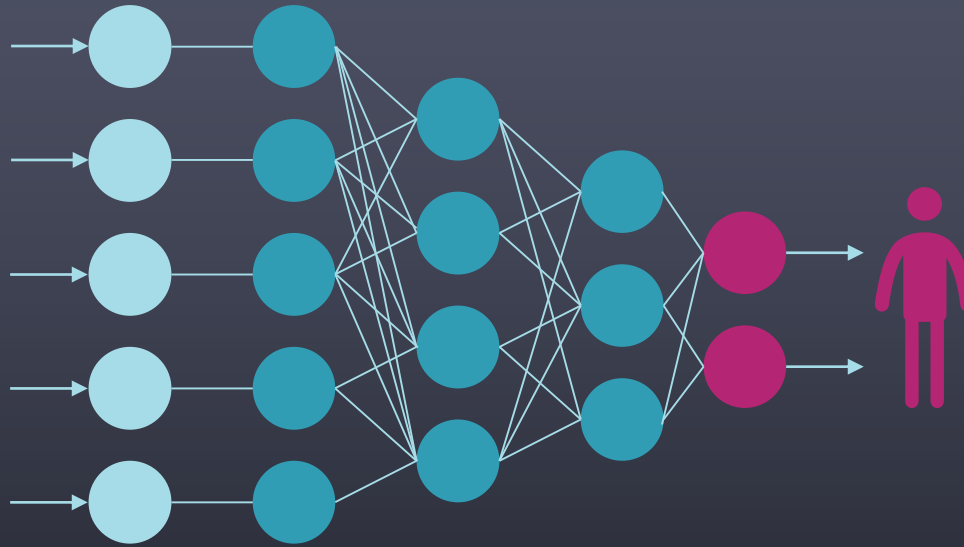


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AI & Obstacle Detection



DETECTION



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Video Example From Karlsruhe

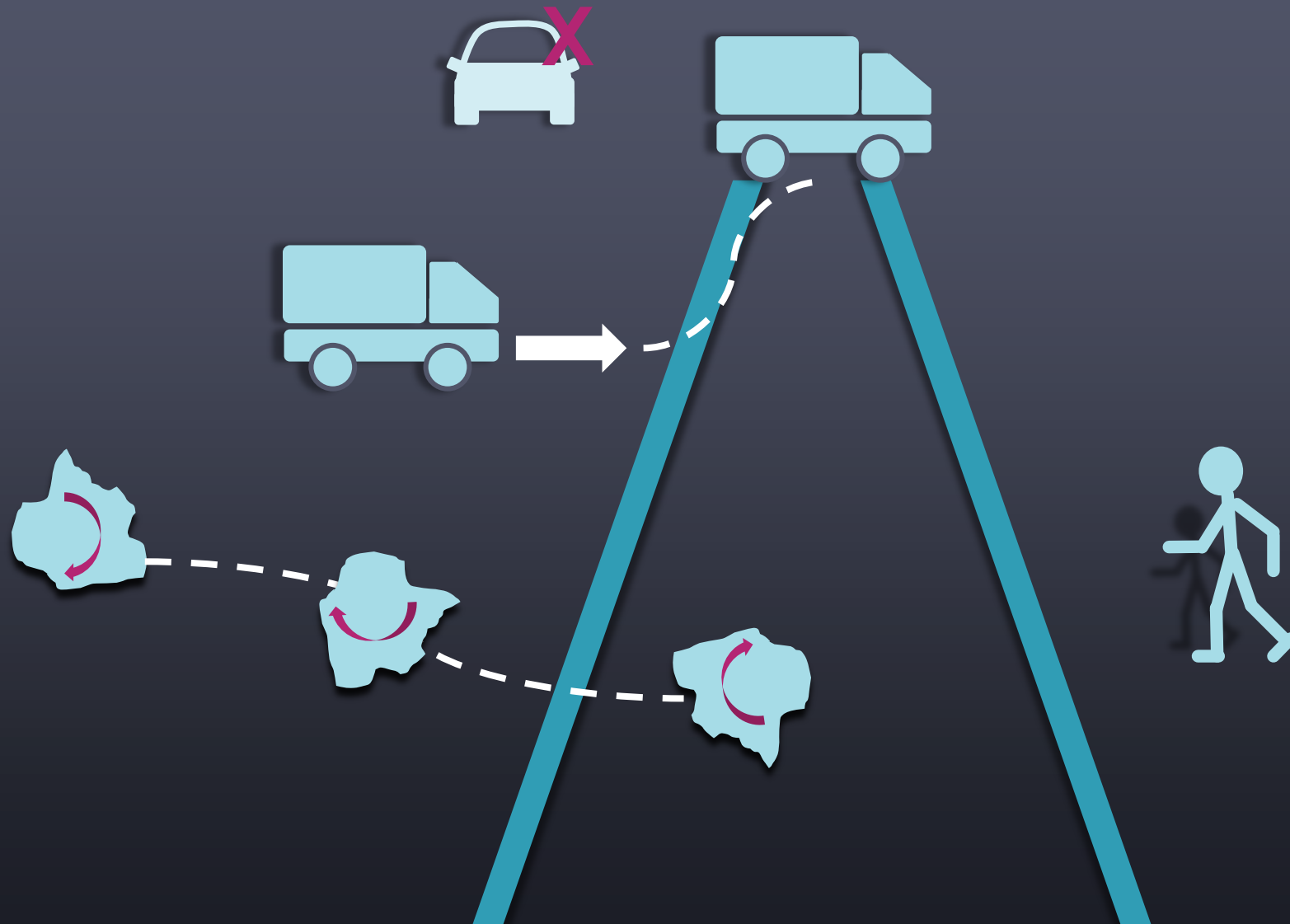


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AI & Intention Detection



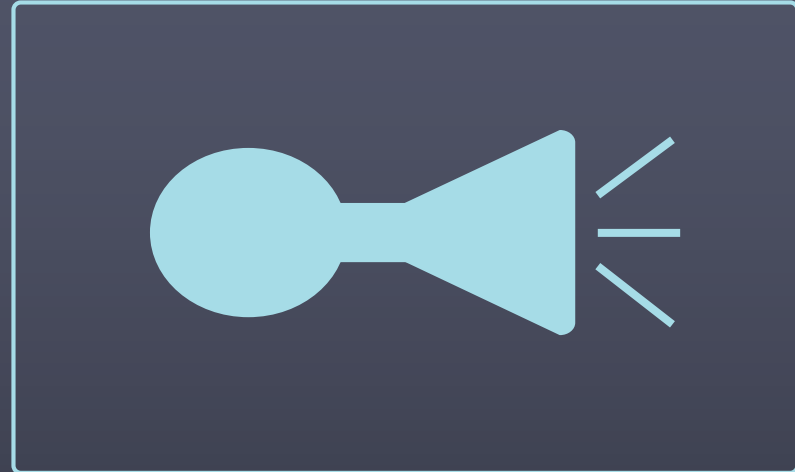
INTENTION



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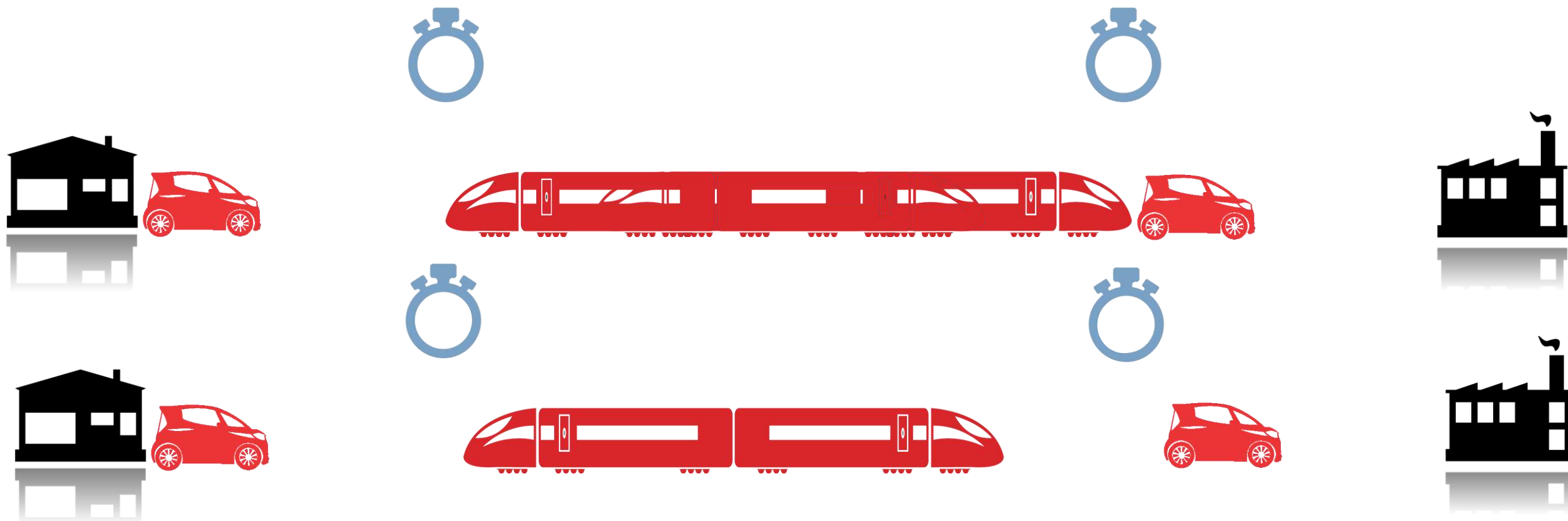


DECISION



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MOBILITY JOURNEY



DOOR TO DOOR MOBILITY

Images courtesy of Shutterstock

Dr. Amine AREZKI



AFP/Getty Images

BAD TRANSMISSION

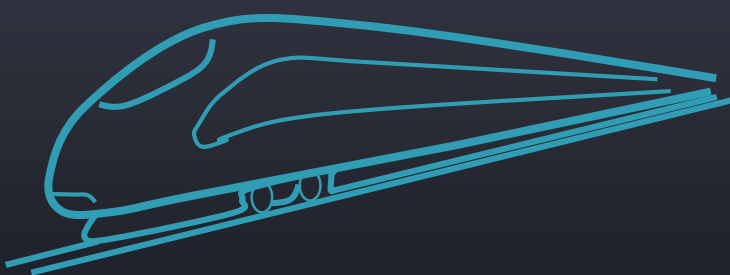


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BAD START

A DEVELOPED COUNTRY IS WHERE DIFFERENT TRANSPORTATION MODES COOPERATE TOGETHER

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