



***Deploying digital
twins in asset
management...***

***to enable
growing
demand for
rail transportation***

The challenge for ProRail (NL)



Amsterdam stations: victims of their own success

- Densification around each station
 - Development of the network
 - Intermodal HUBS
- Significant passenger growth expected at five stations

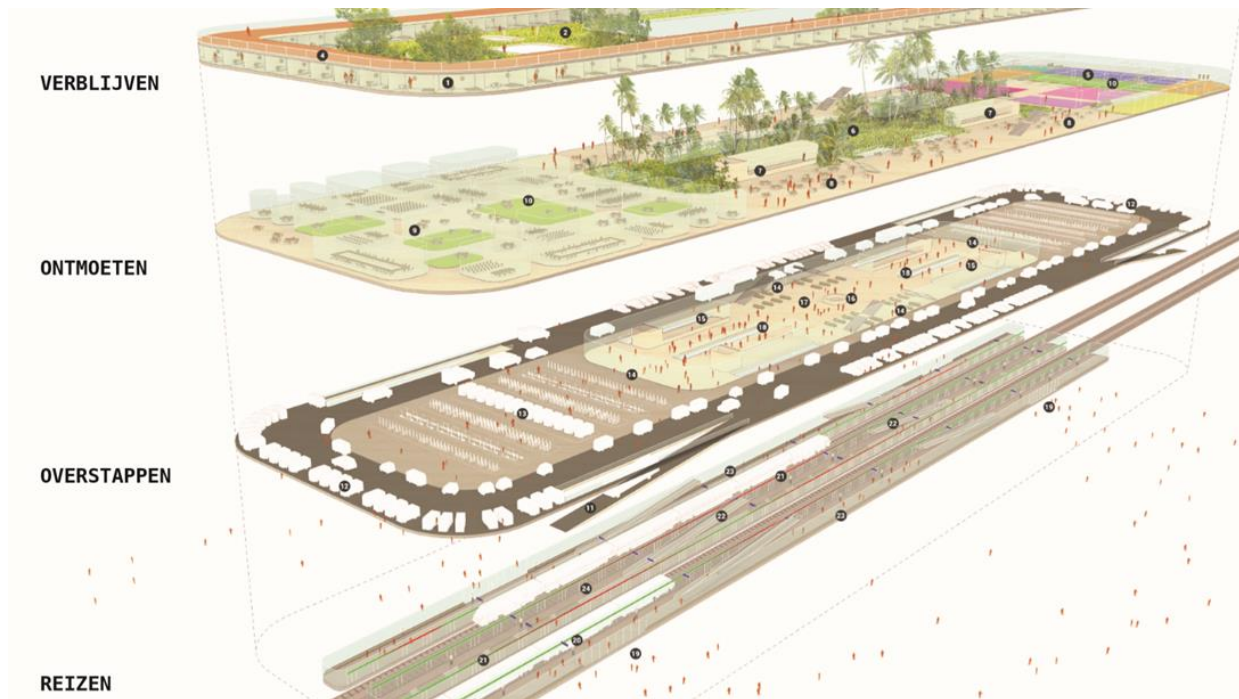
The risks that need to be managed include:

- Passengers waiting in the Danger Zone as no other space is available
- Long lines before exits, especially when 2 trains arrive simultaneously
- Trips and falls on the stairs/escalators as a result of crowding
- Longer berthing times leading to unstable train service

NS (Dutch Railways) about clever solutions:

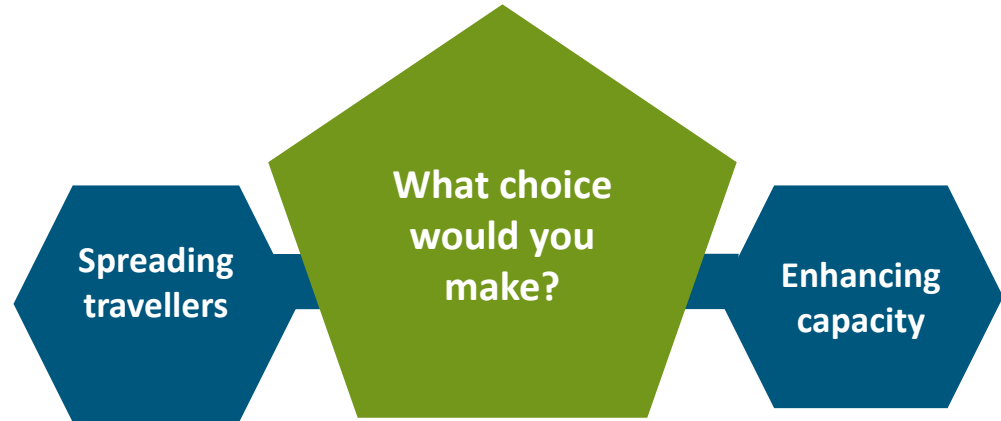


Station NXT!

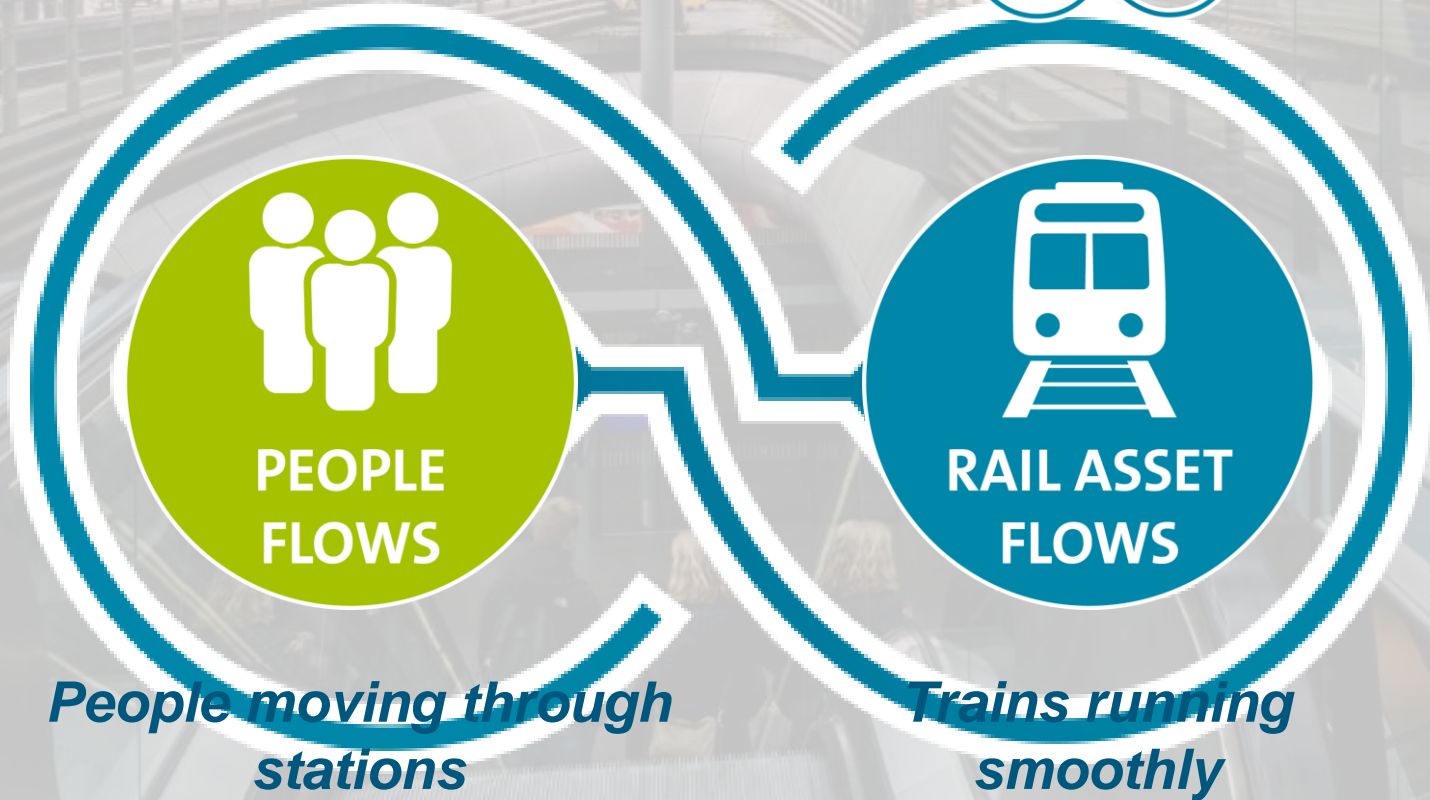


Source: ProRail
stations

What to do?



Smooth Transit



**PEOPLE
FLOWS**

**RAIL ASSET
FLOWS**

*People moving through
stations*

*Trains running
smoothly*



Optimising people flows

Transform insights into effective solutions



Data



Insights



Solutions

Combining our domain knowledge, data science and service design to create effective crowd management solutions



Keeping people flowing

Across cities, stations, airports

GEMEENTE
AMSTERDAM



SCHIPHOL
AIRPORT



NS
STATIONS



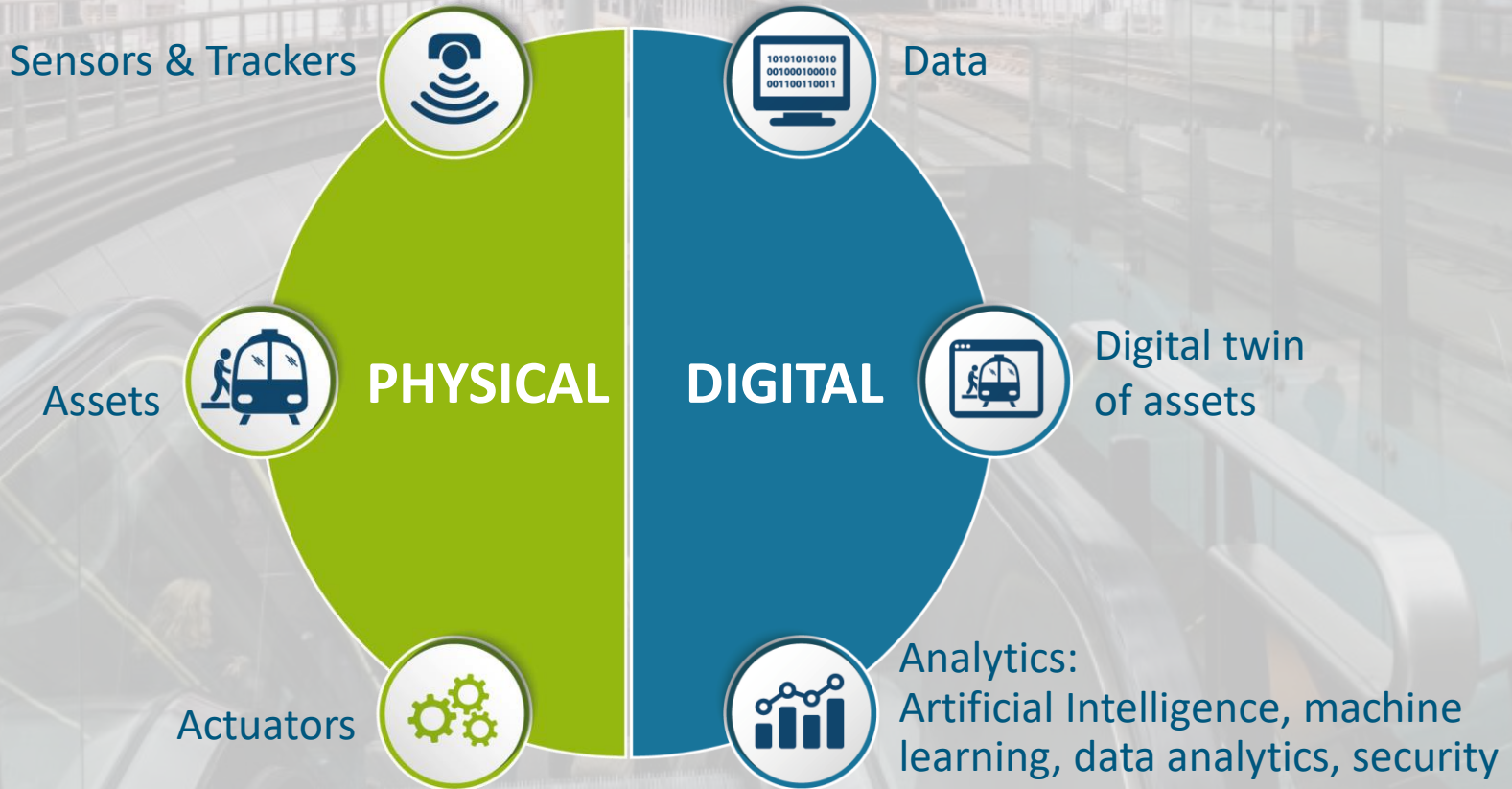


Dynamics of a living rail ecosystem



Integrating IoT, ML and DA in living models that continuously learn and upgrade themselves

Connecting the rail ecosystem





Improving rail asset flows

Utilise real-time and predictive controls



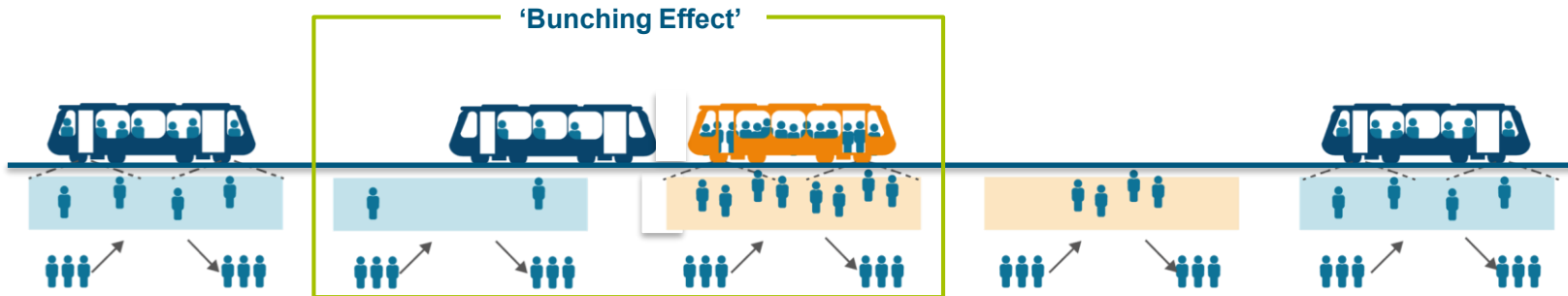
Using multiple data sources – including speed, dwell times and size of trains – to generate insights, moving from reactive to proactive control measures



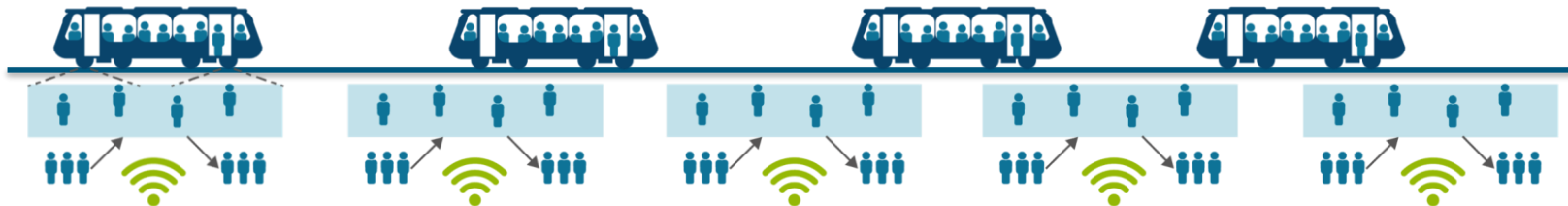
Maintain stability and reliability

Avoid the 'bunching effect'

Disturbed Scenario
(bunching effect)



Smooth Transit Scenario
Controlled Situation

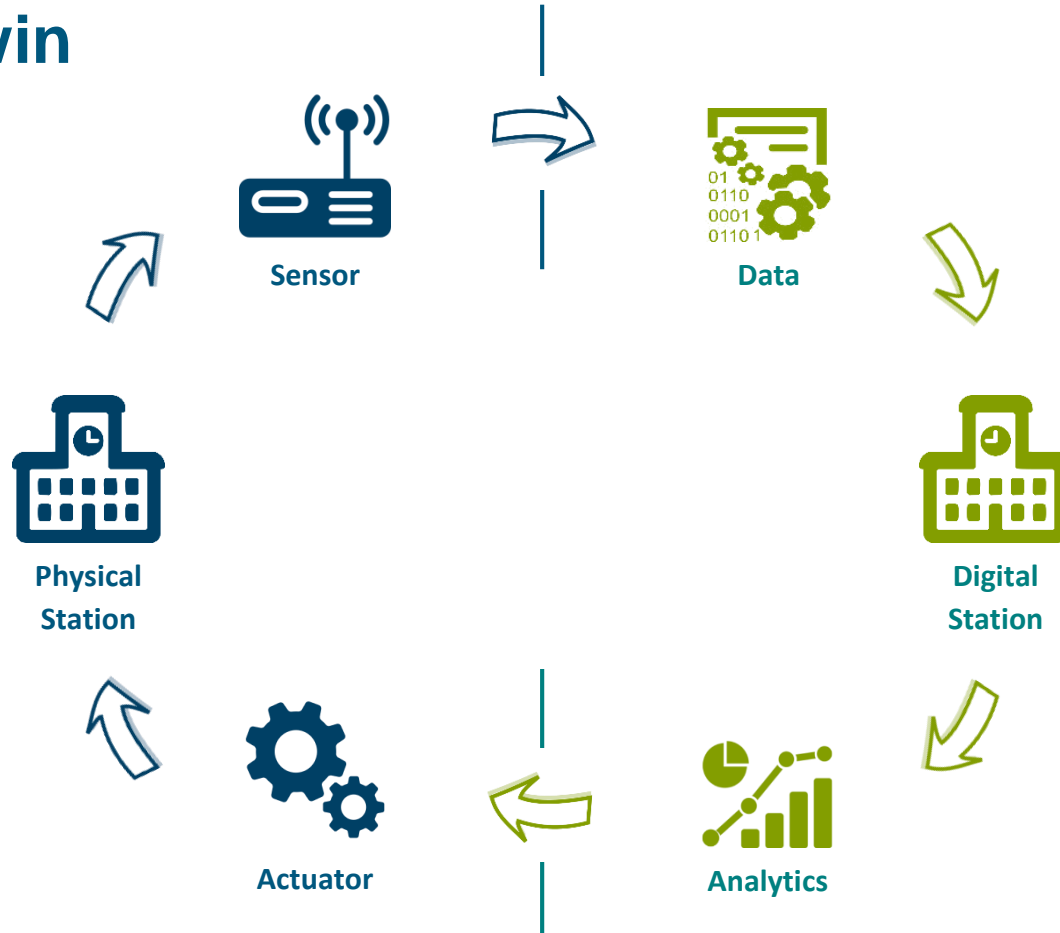


Measure 1:
Delay downstream vehicles

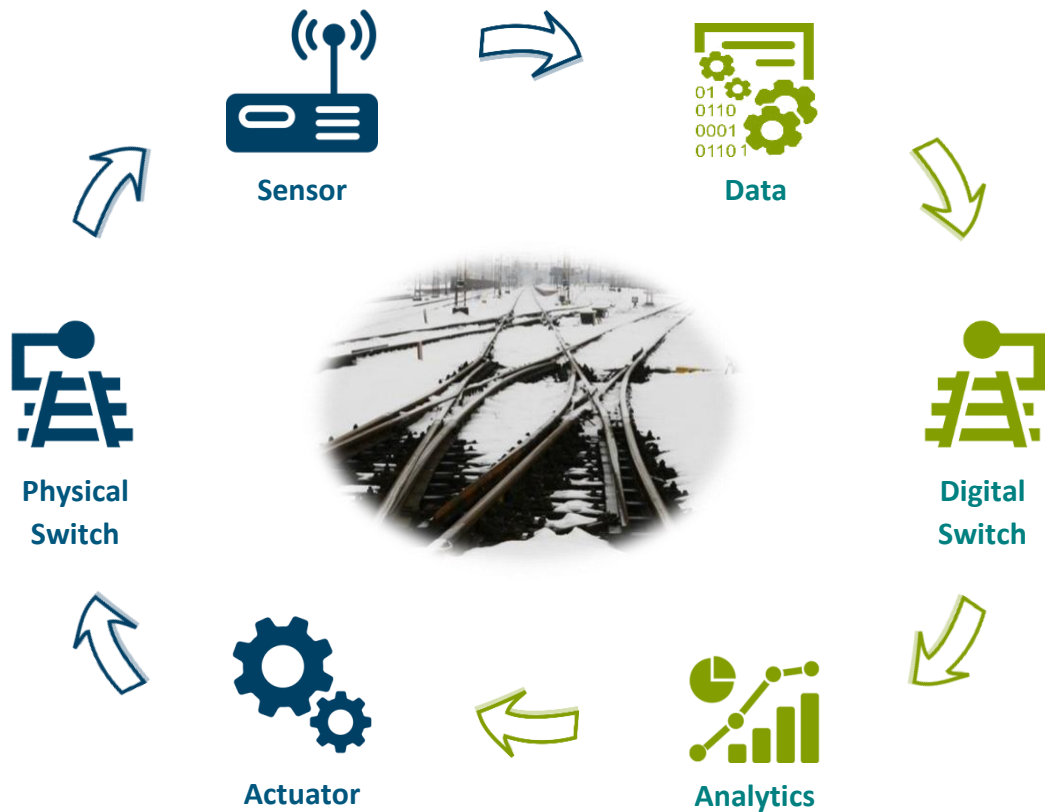
Measure 2:
Control number of passengers coming into station

Measure 3:
Control elevators and wayfinding

Station Twin



Asset Twin



Process Twin



System Twin



Digital twins = Connectivity + Communication + Collaboration

**Holistic view of
ASSETS & PROCESSES**

**LIVE & DYNAMIC
environment**

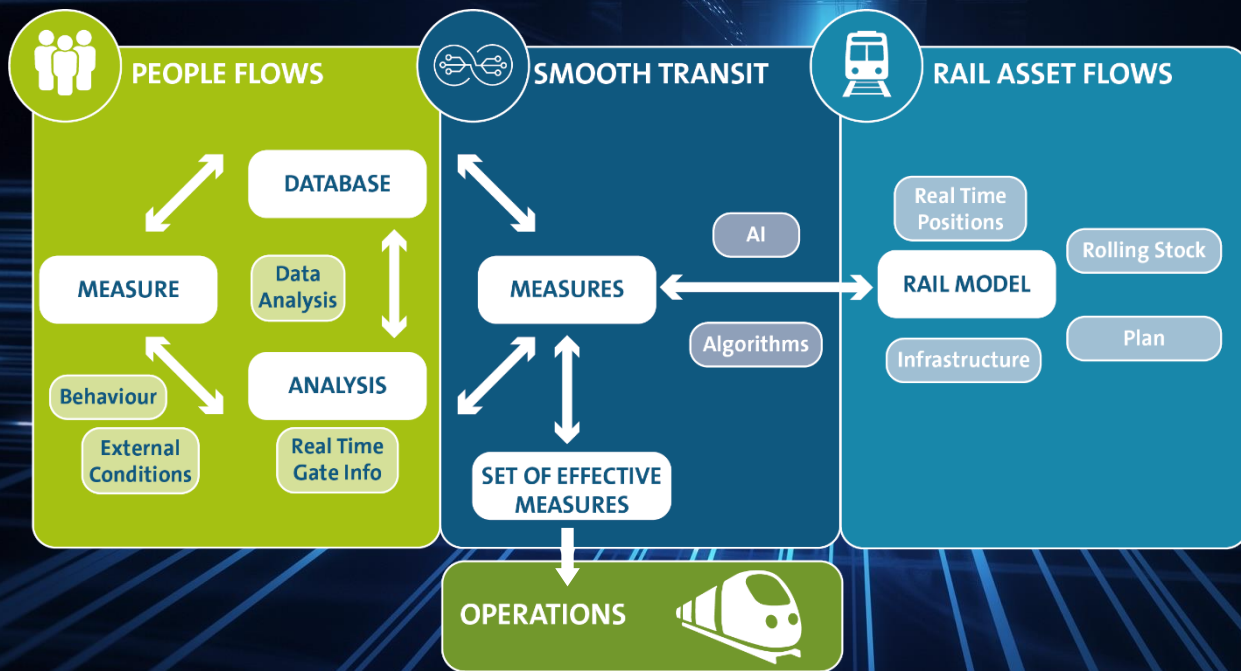
**Analysis &
PREDICTION**

**Optimise
SYSTEM PERFORMANCE**

**Communication &
LEARNING APPLICATION**



Platform architecture



Controlling the operational and passenger effects on the rail network



Smooth Transit

Enhance reliability and safety of (urban) rail transport



By combining people flow measurements and rail asset simulation models, we can predict accurate traffic and passenger conditions to define control measures





Optimising the passenger's journey

Integrating station, train & infrastructure solutions



TRAIN OPERATORS

- ✓ Client satisfaction
- ✓ Reduce delays
- ✓ Meet sustainability goals



TRANSPORT AUTHORITIES

- ✓ Enhance safety
- ✓ Client satisfaction
- ✓ System attractiveness



ASSET MANAGERS

- ✓ Higher throughput of the network
- ✓ Better punctuality

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