



IoT in Action

#IoTinActionMS



IoT and Smartness

Andy Cross

IoT in Action



About Me and Elastacloud

- Andy Cross Founder and Director of Elastacloud, a UK Cloud Data Analytics Consultancy, Azure MVP/Microsoft Regional Director
- Microsoft Azure Gold Partner, Cloud Platform and Data Analytics, OSS Partner of the year 2015, Microsoft Partner of the Year nominee 2018
- Co-founder of UK Azure User Group, IoT and Data Science Innovators UK, Cloud Infrastructure UG, Data Science London
- Author of data science degree academy.microsoft.com
- Running AzureCraft UK annually
- Contributors to open source, several Apache projects including Storm, Spark, Libcloud and Parquet
- 60+ people across London, Notts and Spain

The 4 IoT Problems

1. Physical World

1. Command and Control
2. Measurement

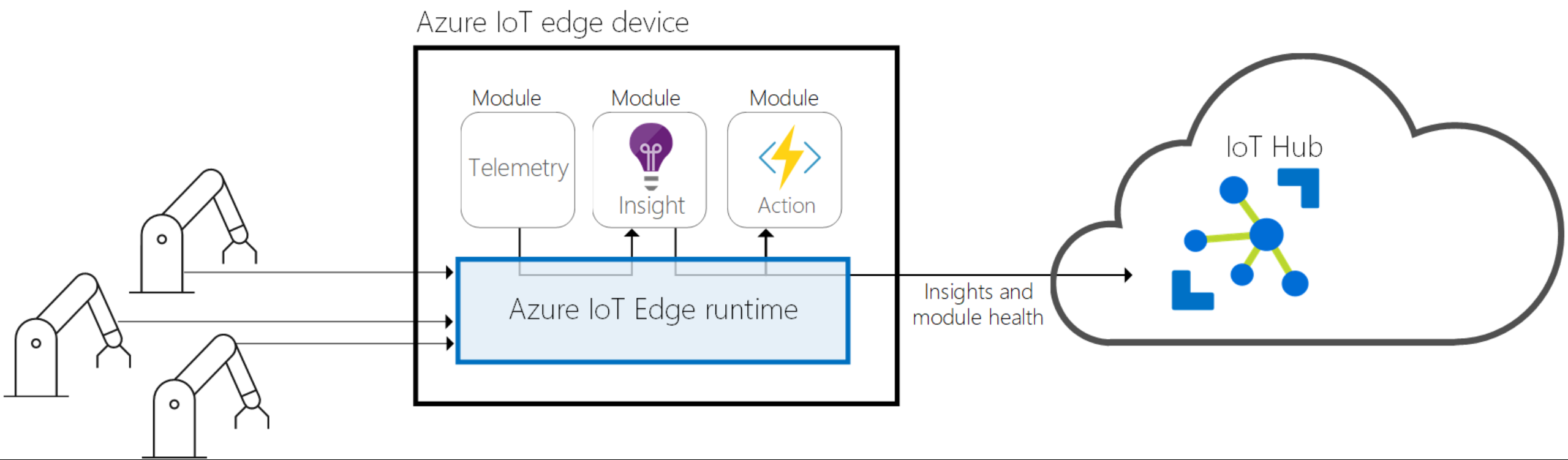
2. The Edge

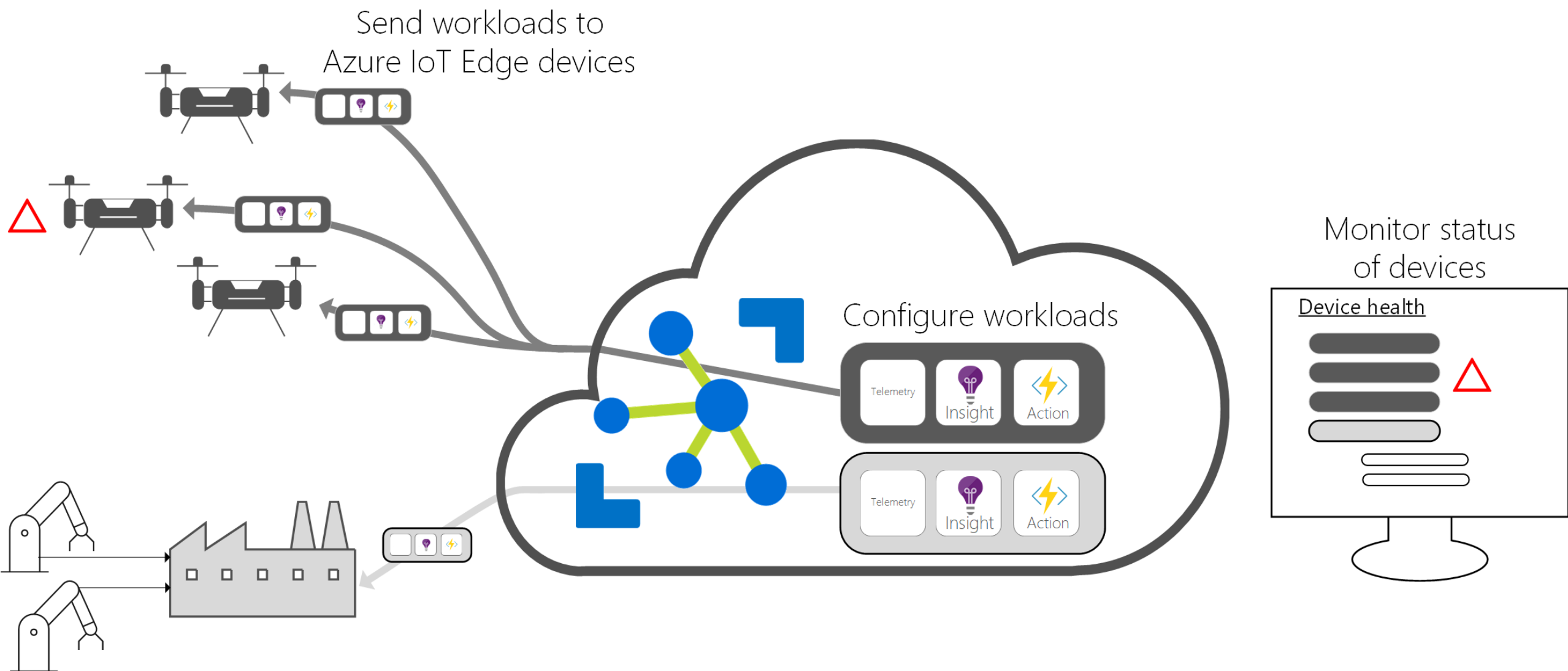
1. Connectivity
2. Micro-Intelligence

3. The Cloud Integration

4. The Intelligence

1. Full context Intelligence over the fleet
2. Insight on trends in performance and degradation





IoT - Physical vs Logical

PHYSICAL
WORLD



Data

Control

System

DEVICES

Process

DIGITAL
WORLD

Measure

Insight,
Optimization

Operations



Data

Control

PEOPLE

Context

SPACES

Intent,
Context

Insight,
Optimization

Insights



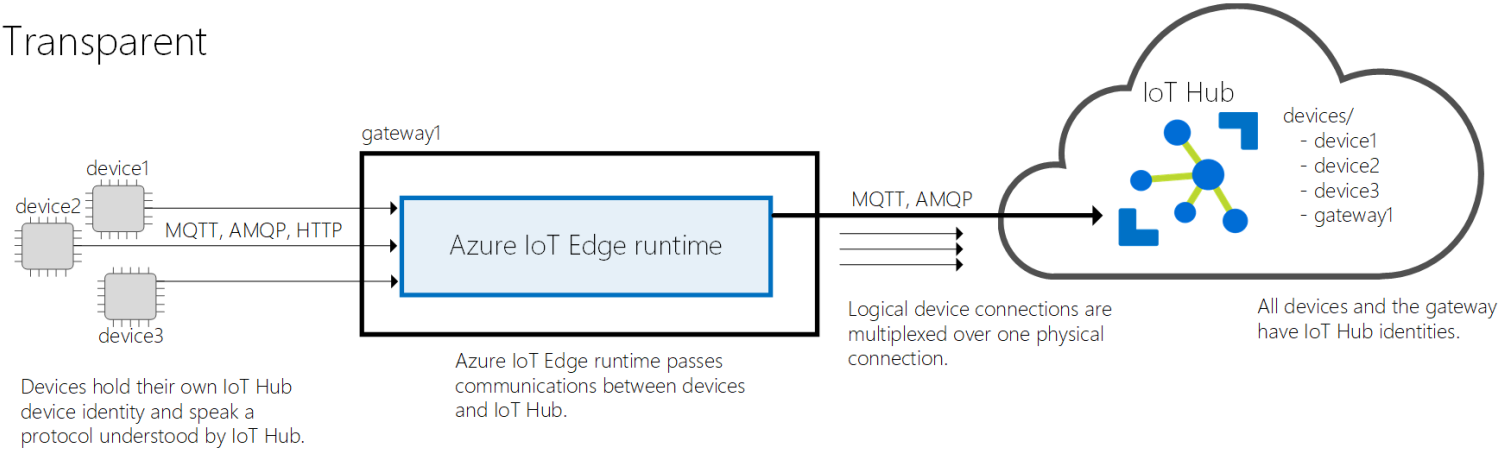
Measure

Assistance,
Task completion

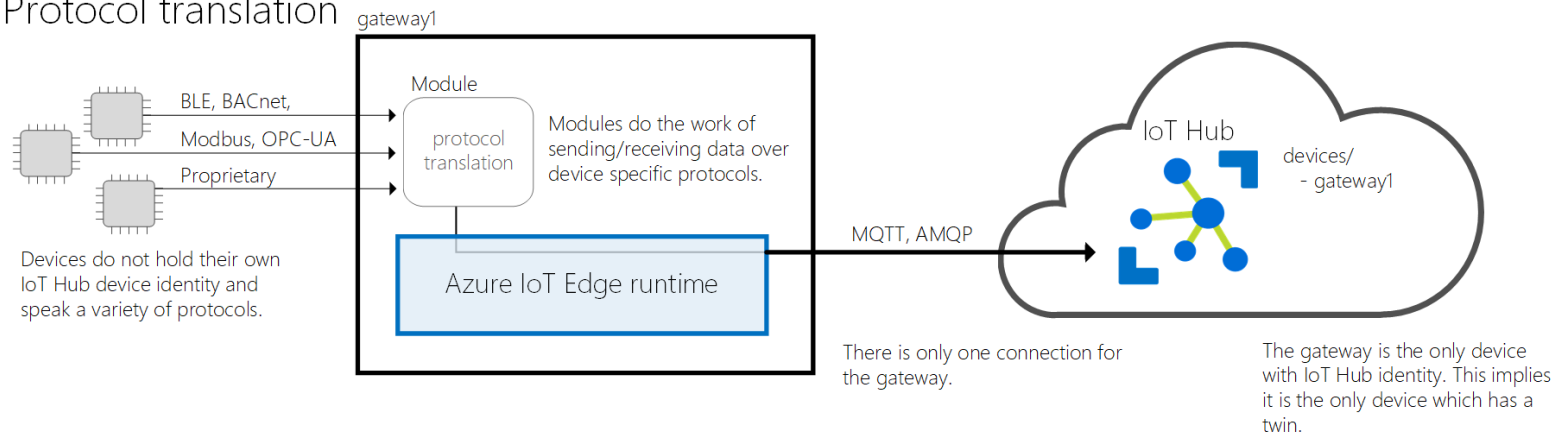
Experience



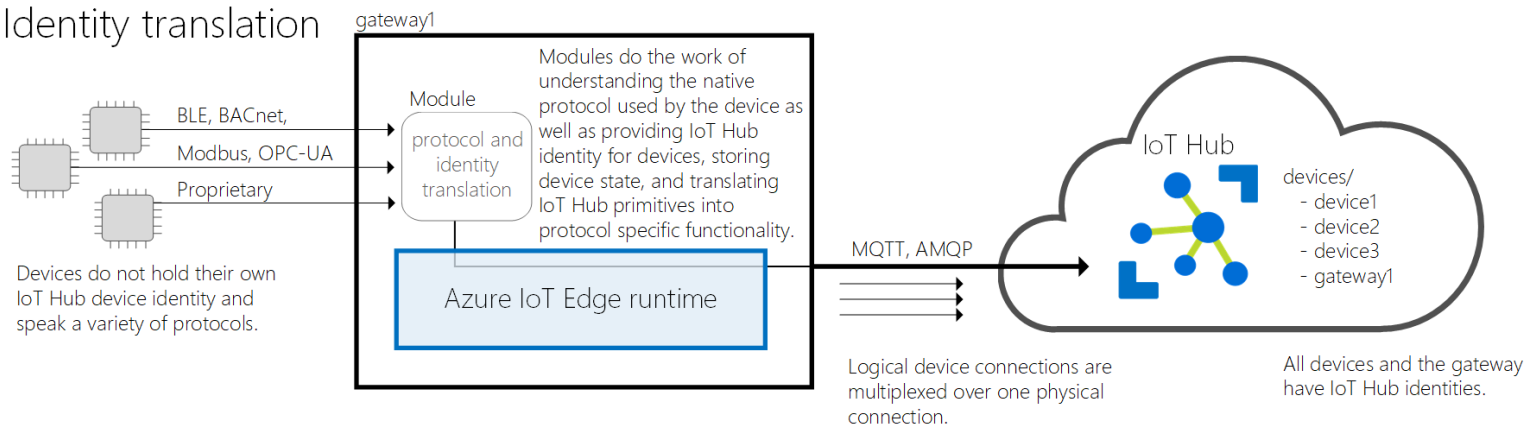
Transparent



Protocol translation



Identity translation



Lightning Case Studies

- Energy
 - Consumer side
 - Generation side
- Internet of Food
- Manufacturing IIoT

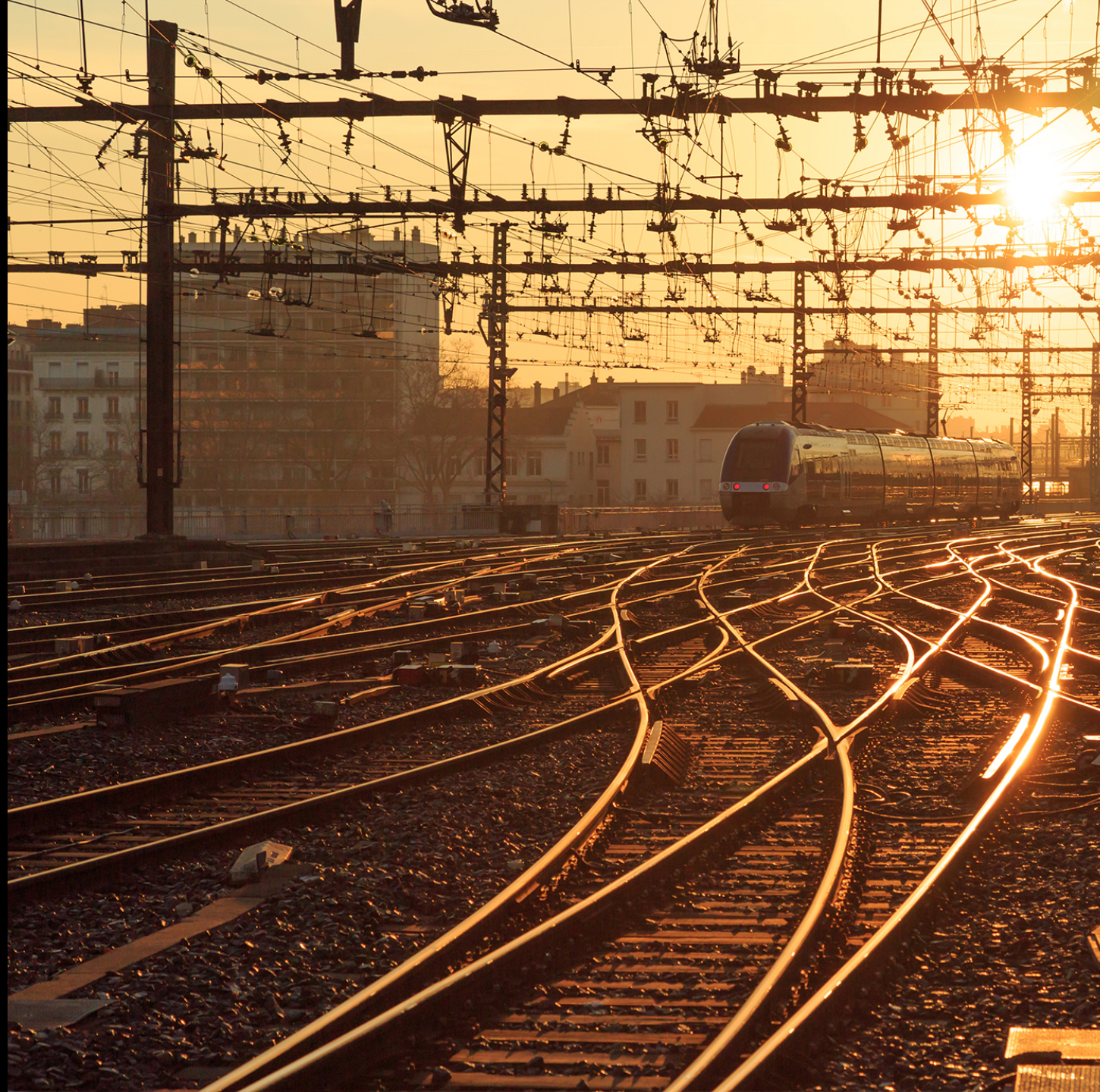




Rail Transport

Logistics and Passenger Movement

IoT in Action



Elastacloud; In Rail

- SME advisors to Rail Sector Deal on Data & AI
- Patron members of RFM
- Rail Safety Standards Board
- Members of Midlands Engine & Midland Rail Cluster Incl. UKRRIN
 - UKRRIN Digital Twin
 - 5G IOT Testbed- £200m
- Strategic Data & AI partner with Porterbrook Leasing
- Rail Freight Group member



► Harness the energy, drive and innovation of SMEs to meet the needs of the global railway market

Transforming the use of data

The industry holds a lot of data about rail users and the performance of the network. There is now an opportunity to provide further value from data by making further datasets open for exploitation in order to enhance passenger experience and door to door journeys. Progress has been made with regards to data sharing. As part of the wider transparency commitment, in 2012 Network Rail released open data which they have continued to grow, and now includes access to a number of operational data feeds, including train positioning and train scheduling data across the network.

Porterbrook Rail Leasing



- ❑ One of three train leasing businesses in UK
- ❑ Own 40% of all rail rolling stock in UK
- ❑ Over 5,000 trains on UK network
- ❑ 2019- Developed the UK's first hydrogen train
- ❑ IOT to deliver improved in-service performance KPI's is at the heart of their innovation strategy



IOT in Rail- Modernising to Edge Technology



- ☐ Engine performance monitoring
- ☐ On train systems condition monitoring
- ☐ Passenger safety monitoring
- ☐ Saloon environment monitoring
- ☐ Power management

HITACHI
Inspire the Next



HASLERRail

THALES

BOMBARDIER

eyeTrain

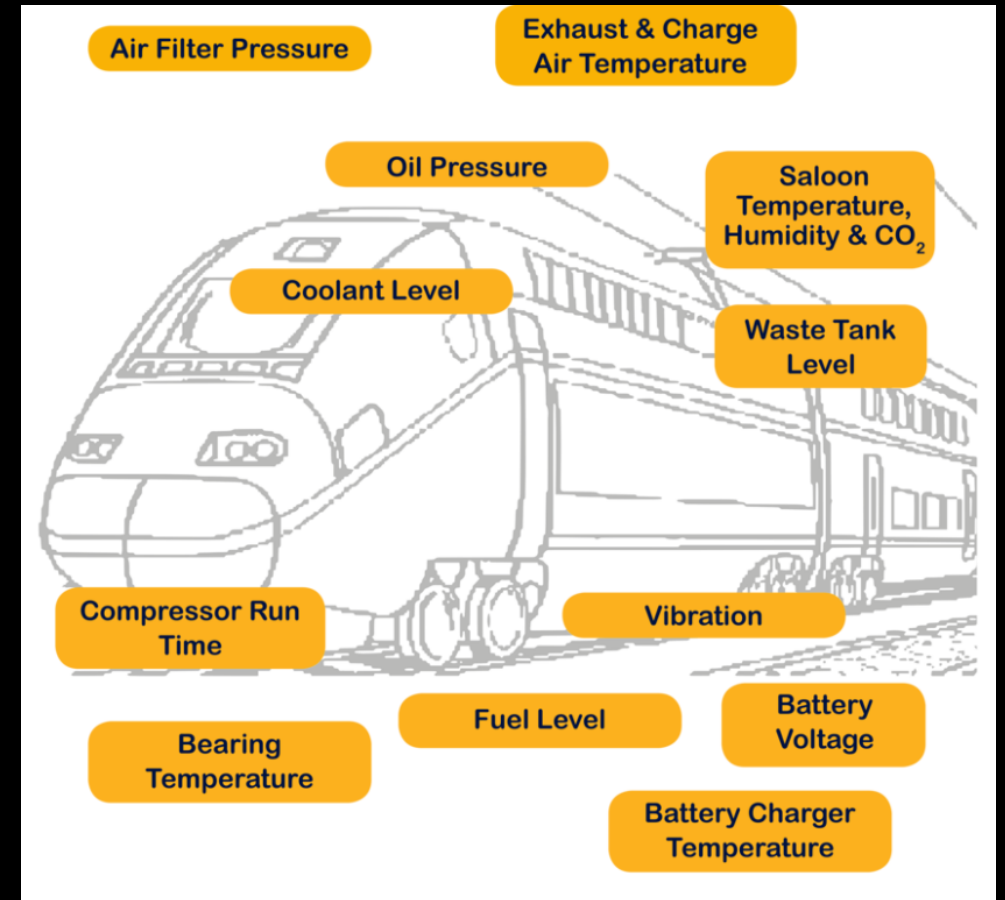


IOT in Rail- Modernising with Edge Technology

- ❑ Fuel Level Monitoring
- ❑ Exhaust and charge air temperature
- ❑ Remote Saloon Temperature Monitoring
- ❑ Coolant Level Monitoring
- ❑ Bearing Temperature Monitoring
- ❑ Alternator Temperature Monitoring
- ❑ Battery Charger Temperature Monitoring
- ❑ Air Flow Monitoring
- ❑ Vibration Monitoring
- ❑ Gearbox Temperature Monitoring

Miles per technical Incident (MTIN)

- ❑ CSF KPI for train operators and rolling stock owners
- ❑ Delay Repay costs c. £50 per minute
- ❑ Critical measure of performance monitored by DFT



Resolving the Key Issue by using Edge Computing

- Rail Systems are highly measured
 - Require safety and compliance testing
- Devices are sometimes connected (often GPRS)
 - Limited throughput
 - Backlog build up then transferred traditionally (in depot, via USB)
 - Leads to **trains that run out of fuel!**
- Devices are data loggers and READ-ONLY
 - Command and Control is impossible
- Edge devices run Intelligent Analytics on the train
- Can prioritise message distribution and alerting
- Can adjust low risk factor systems (HVAC/Lighting/not brakes)

What are AI Problems worth solving?

Platform 10
Hbr

Page 2 of 2

Ssea
Hbr.

Trains
Due to S

16:42 Platform --
Basingstoke

Calling at: Page 1 of 1
Surbiton
Walton-on-Thames
Weybridge
Woking
Brookwood
Farnborough
Fleet
Winchfield
Hook
& Basingstoke.

South West Trains

16:42 Platform --
Shepperton

via Kingston
Calling at: Page 2 of 2
Fulwell
Hampton
Kempton Park
Sunbury
Upper Halliford
& Shepperton.

South West Trains

16:45 Platform --
Hounslow

via Richmond
Calling at: Page 2 of 2
Twickenham
Whitton
& Hounslow.

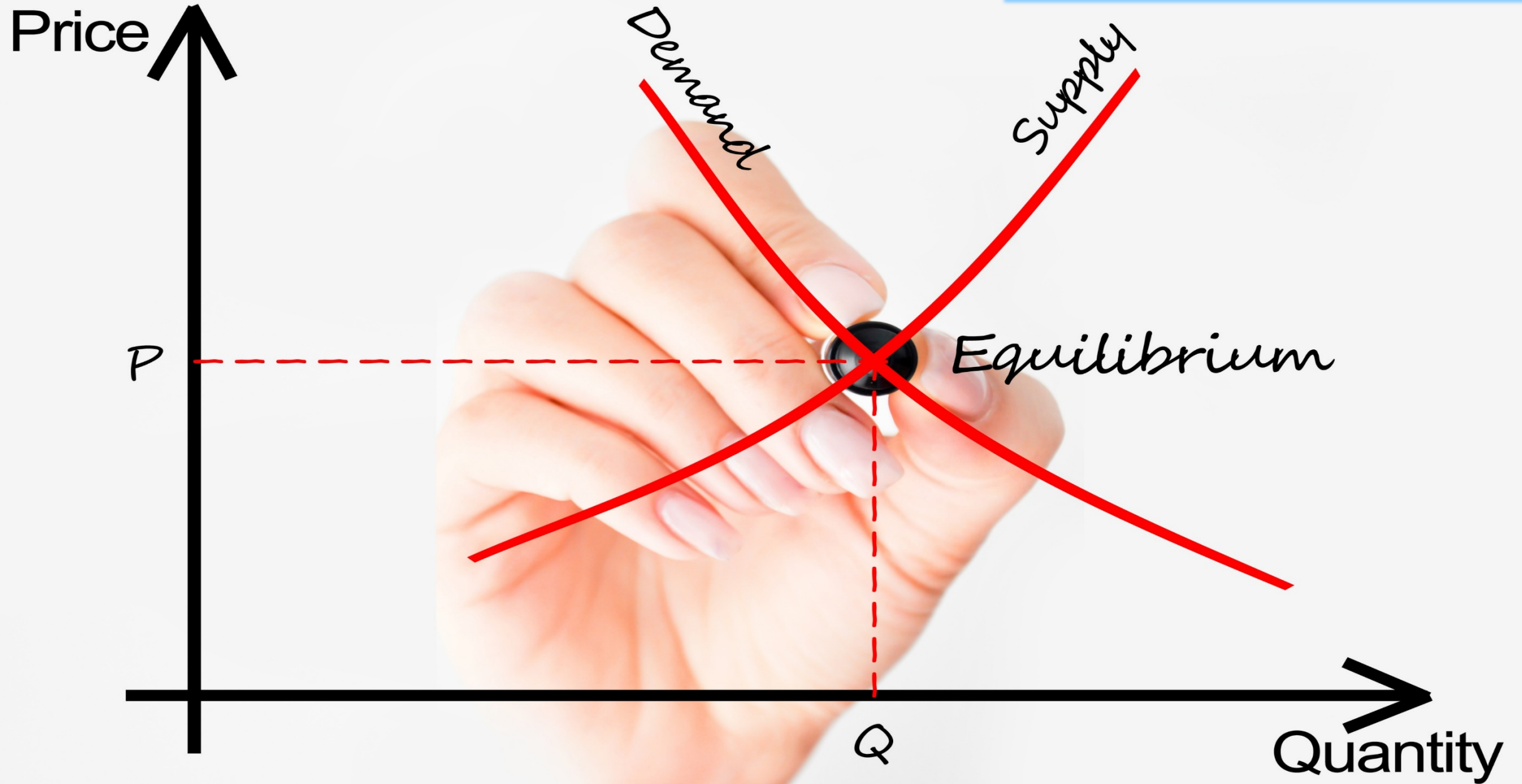
South

Platform --
Hbr

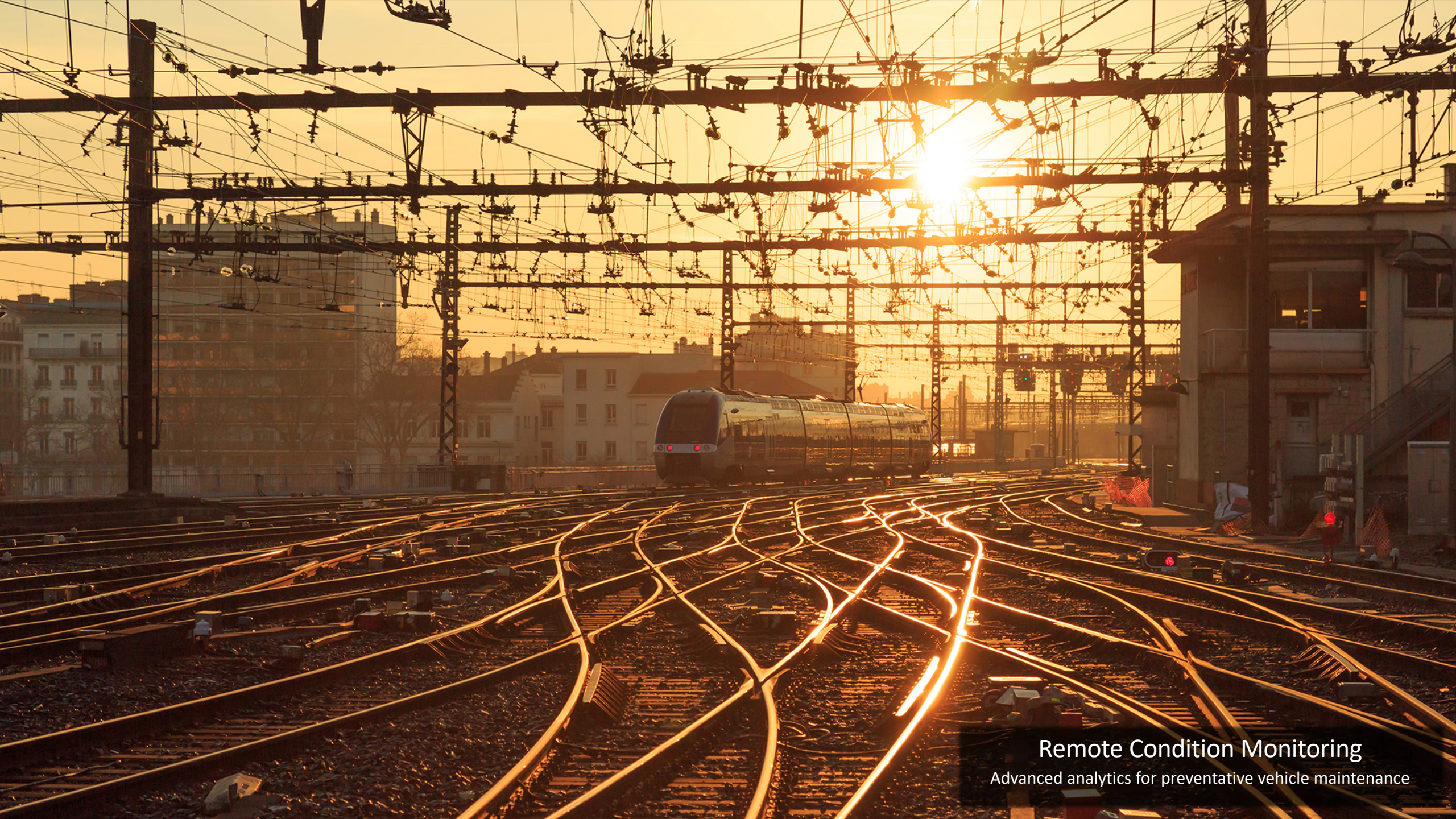
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Ssea

Hbr.



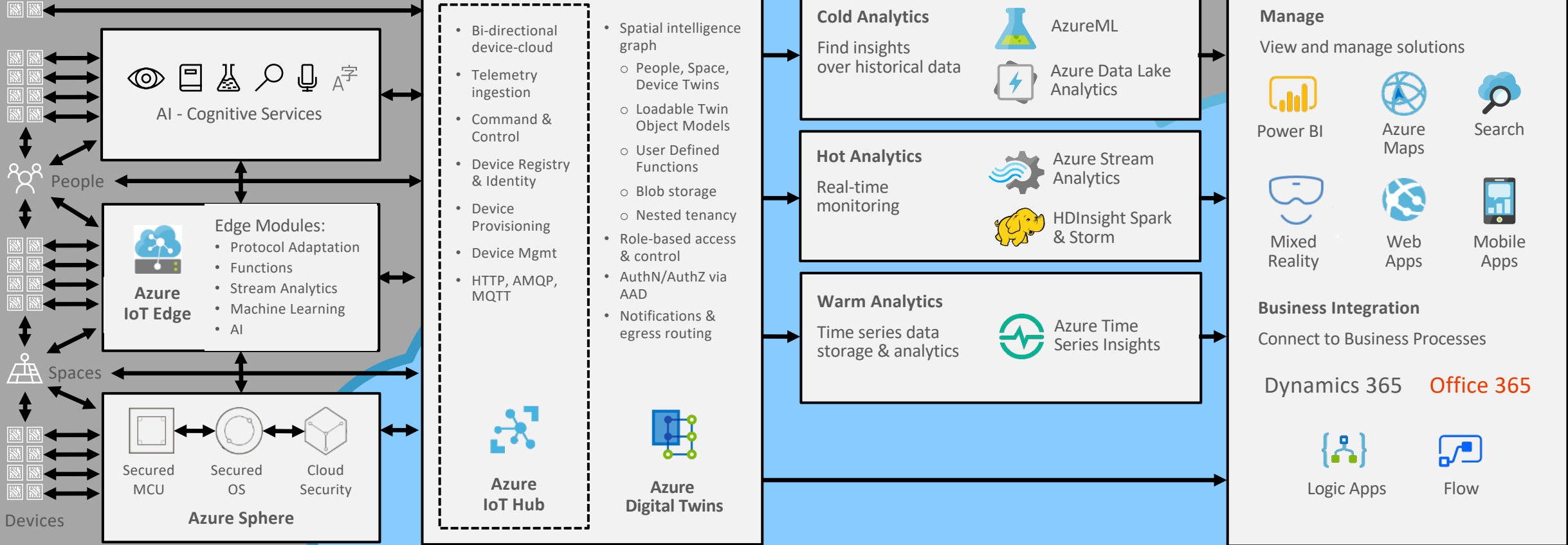




Remote Condition Monitoring

Advanced analytics for preventative vehicle maintenance

RTOS, Linux, Windows, Android, iOS



THINGS

INSIGHTS

ACTIONS

Railtime

A simple demonstrator of predicting train delays

RailTime

Arrivals and Lateness



ALL TRAINS

DELTAs

...	Station Name	Type	Lateness	Prior Stanox	Prior Lateness	Predicted Next Stop Lateness
ARRIVAL	York Stn	PASSENGER AND PARCELS	-60	16495	-30	-64.8321838
ARRIVAL	Sheffield Stn	PASSENGER AND PARCELS	300	24108	420	278.5798
DEPARTURE	Royston Stn	PASSENGER AND PARCELS	-30	53221	-30	-26.5684719
DEPARTURE	St Albans Stn	SPECIAL TRAINS	-240	63551	-60	-186.62738

Lateness

Average

Average Lateness of trains



Prediction

Prediction

Average Predicted next Lateness of trains



