

Alstom HealthHub

Predictive data analytics for maintenance

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September 22nd, 2016



Towards Smarter Mobility

Our accumulated digital universe of data will grow from 4.4 zettabytes today to around 44 zettabytes by the year 2020¹

Machine-to-machine (M2M) connections will grow from 5 billions in 2016 to 30 billions in 2020²



Intelligent use of data will be key!

¹Forbes, SEP 30, 2015 "Big Data: 20 Mind-Boggling Facts Everyone Must Read"

²"IDC Predictions 2015: Accelerating Innovation — and Growth — on the 3rd Platform," December 2014





Predictive maintenance

A close-up photograph of a hand holding a black gas pump nozzle, which is inserted into the fuel tank of a silver car. The nozzle has a yellow and black label with the word 'ultimate' visible. The car's fuel filler door is open, and the nozzle is positioned over the fuel inlet. The background is slightly blurred, showing a red object on the left and a person's leg in blue jeans on the right.

Imagine you had a car...

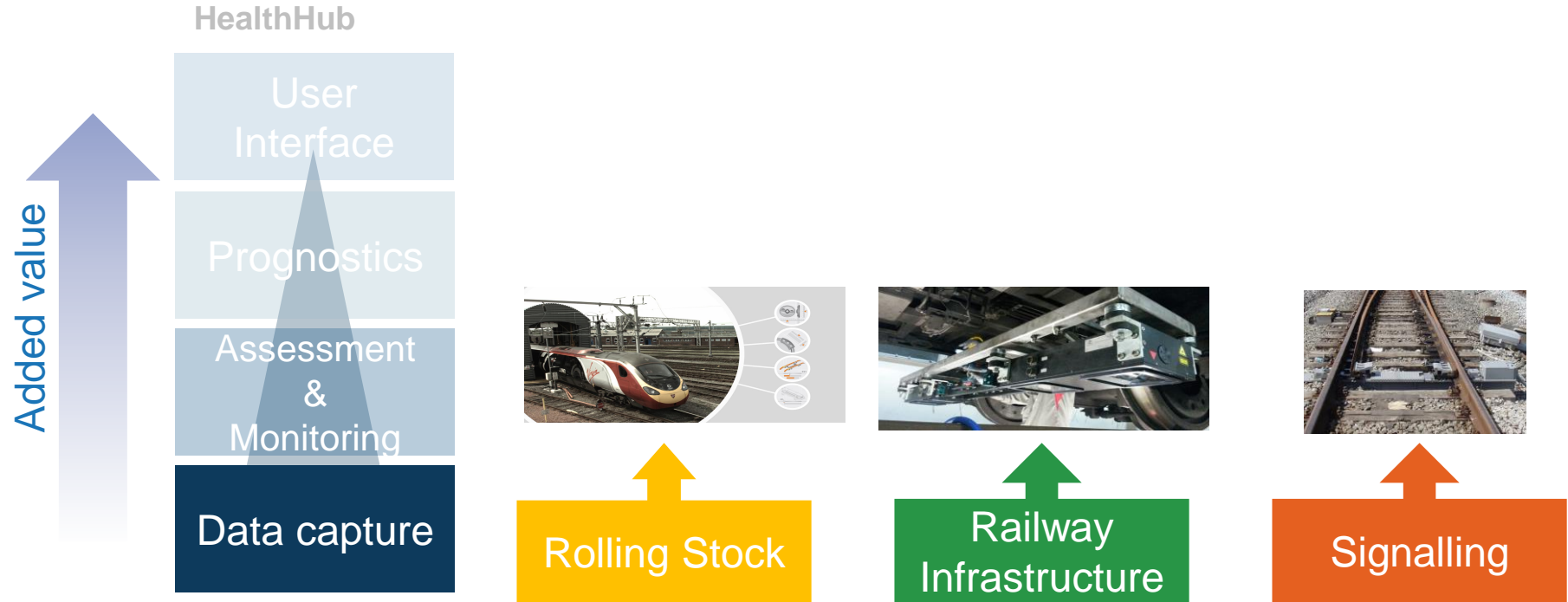
When would you refuel?

What is predictive maintenance?

Type of maintenance	Preventive			
	Corrective	Preventive	Condition-based	Predictive
				
	When it fails	Every day	Upon low fuel indication	Upon measurement and prognostic
# of Refills	Few	Many	Few	Minimal and planned
Car Availability	Low	Medium	High	High
Breakdown risk	100%	Low (if no change in usage)	Low	Lowest (if accurate algorithms)

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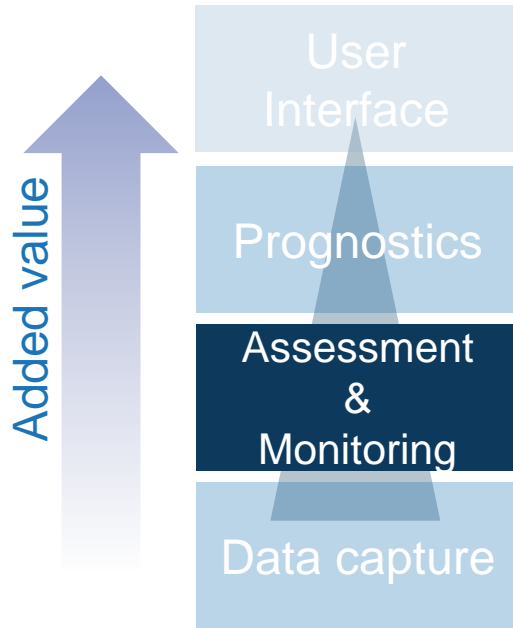
Predictive Maintenance for every asset



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Predictive Maintenance – Real Time asset health monitoring

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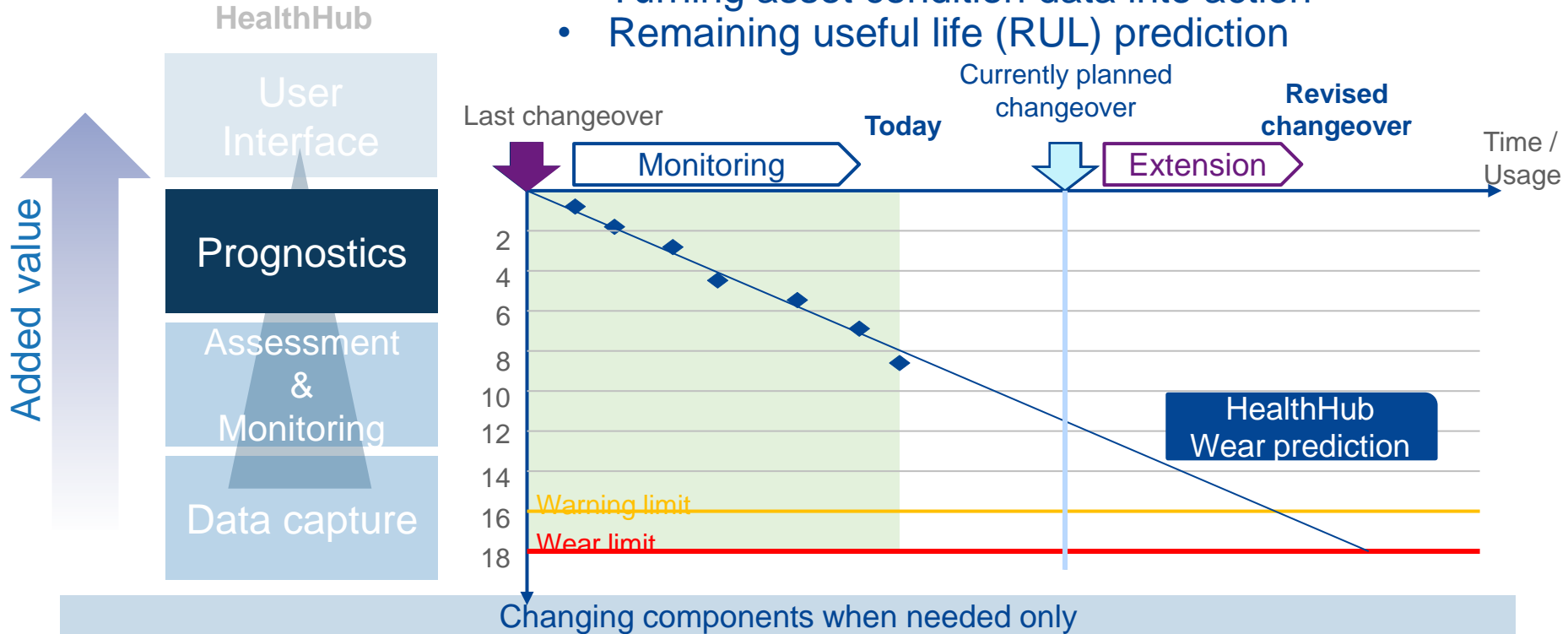
- Asset data from various sources
- Displayed in ergonomic user interfaces
- From fleet view to train view to component view
- Current and predicted state of health

To turn assets monitoring data into actions

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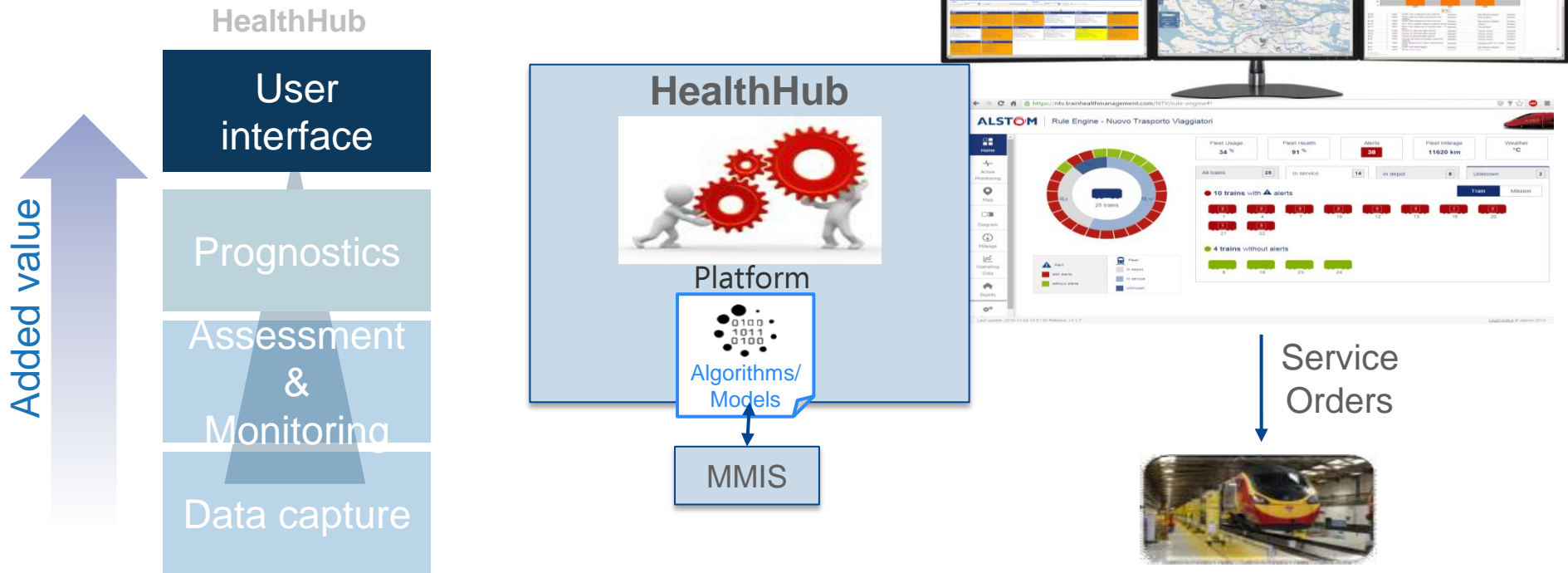
Predictive Maintenance – Prediction of remaining useful life

- Turning asset condition data into action
- Remaining useful life (RUL) prediction



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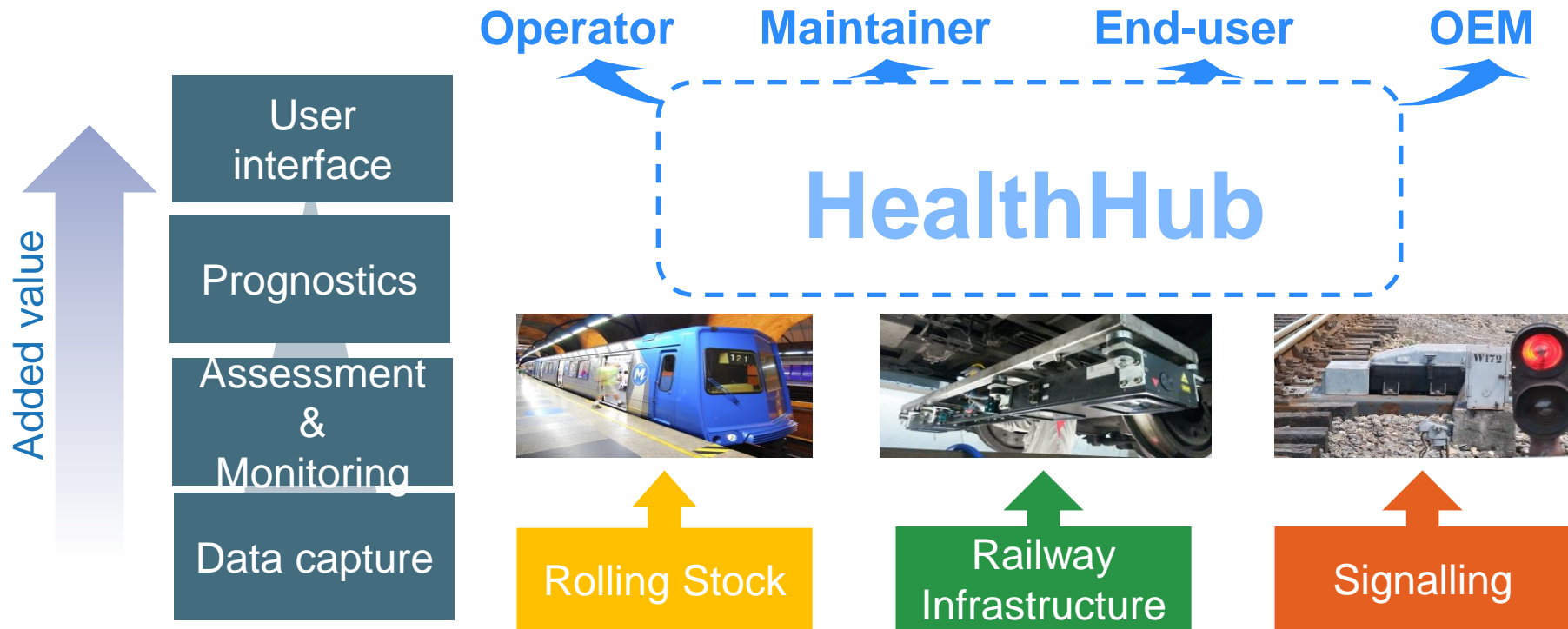
Predictive Maintenance – Prediction of remaining useful life



An integrated platform

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Predictive Maintenance for every asset



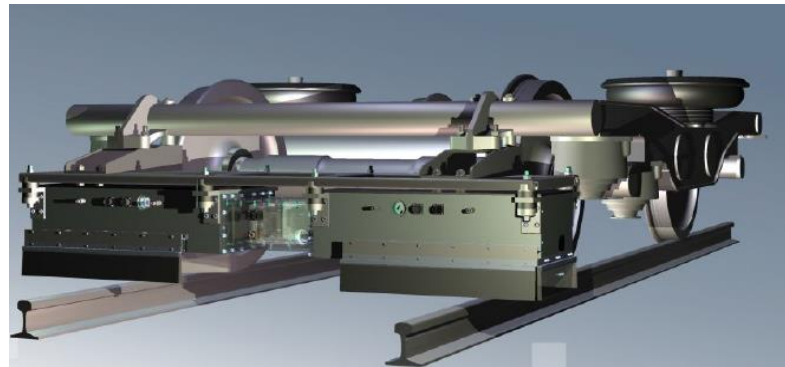
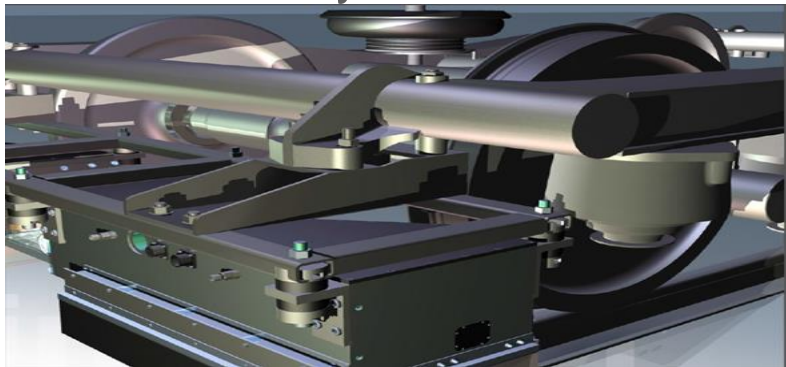
TrainScanner – Automated trains measurement



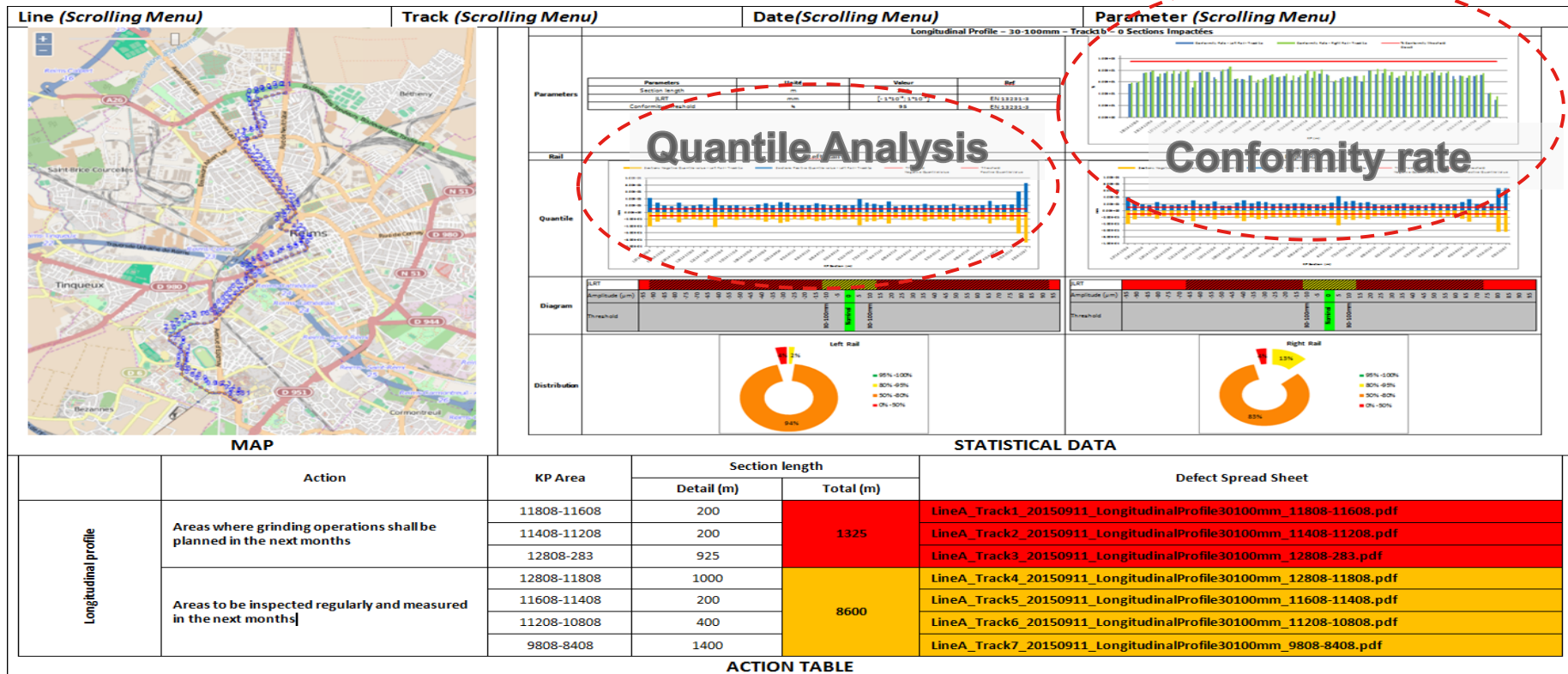
Applicable as well to metro

Track Health Assessment service: Metro use case

Train-mounted systems



TrackTracer: Reports



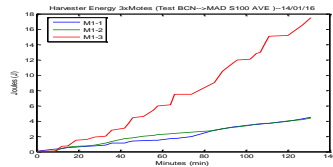
The Motes: Train component monitoring

MULTIPLE MONITORING FEATURES

**BESPOKE & EASY
INSTALLATION**

**WIRELESS & SECURE
CONNECTIVITY**

**ENERGY
HARVESTING**



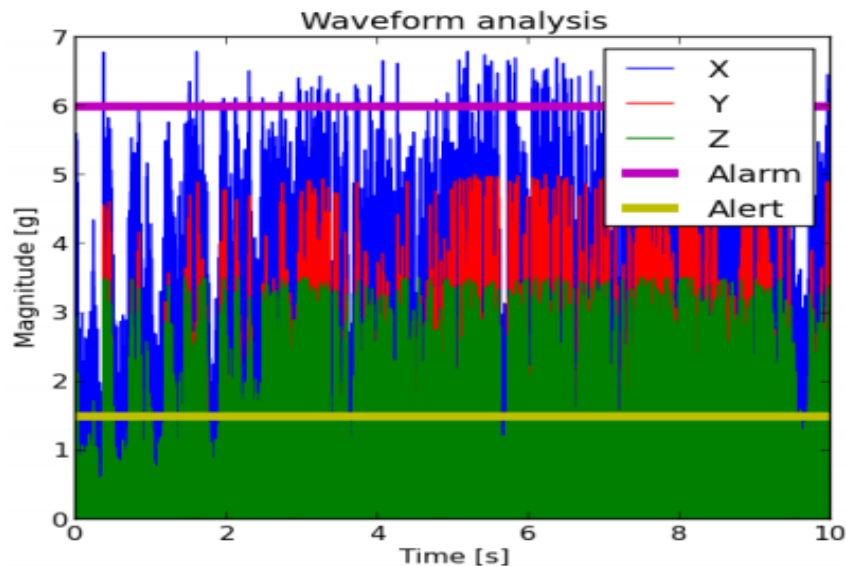
The Motes: Metro case study

System configuration



- 1 Gateway, 3 bridges, 24 motes, 1 tablet
- Vibration is captured
- Magnet attachment
- Axle-boxes monitoring
- 4 seconds, 1 axis, 3.2kHz
- Depot max speed = 5mph
- Powered by train batteries
- Tailor-made analytics for health assessment

Health Diagnostic



Turnout case study



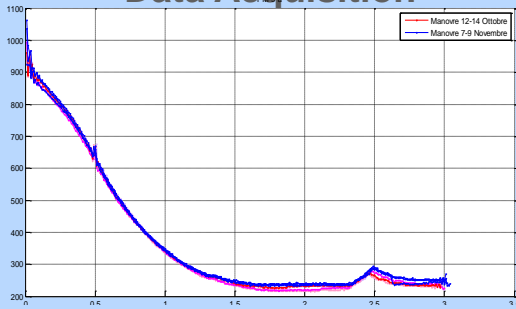
Ufficio: EVOLUZIONE ECONOMICA/PIRELLA Relativo al programma _____
 Reparto: ANALISI E PROGETTO del _____
 Uscita: 1981 del _____

**RAPPORTO SULLE VERIFICHE
DEI PARAMETRI FUNZIONALI DEI DEVIATI**

Verifica effettuata il: 20.4.81 Lunedì 20/04/81
 Stato: _____ Stazione o locale: San Giovanni 84

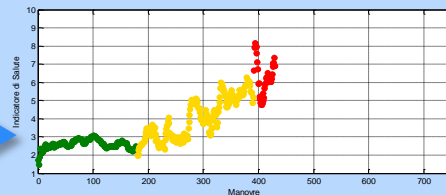
DEVIATI CON MANOVRA ELETTRICA

Deviatione	Spostamento in mm	Accelerazione in mm/s ²				Acceleramento in mm/s ²		Note
		max	min	max	min	max	min	
602	PSD	-	-	-	-	20,0	20,0	Tutti i valori fuori TB
604	N	-	-	-	-	-	-	
612	-	-	-	-	-	-	-	



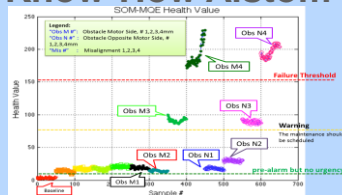
Analysis

Model

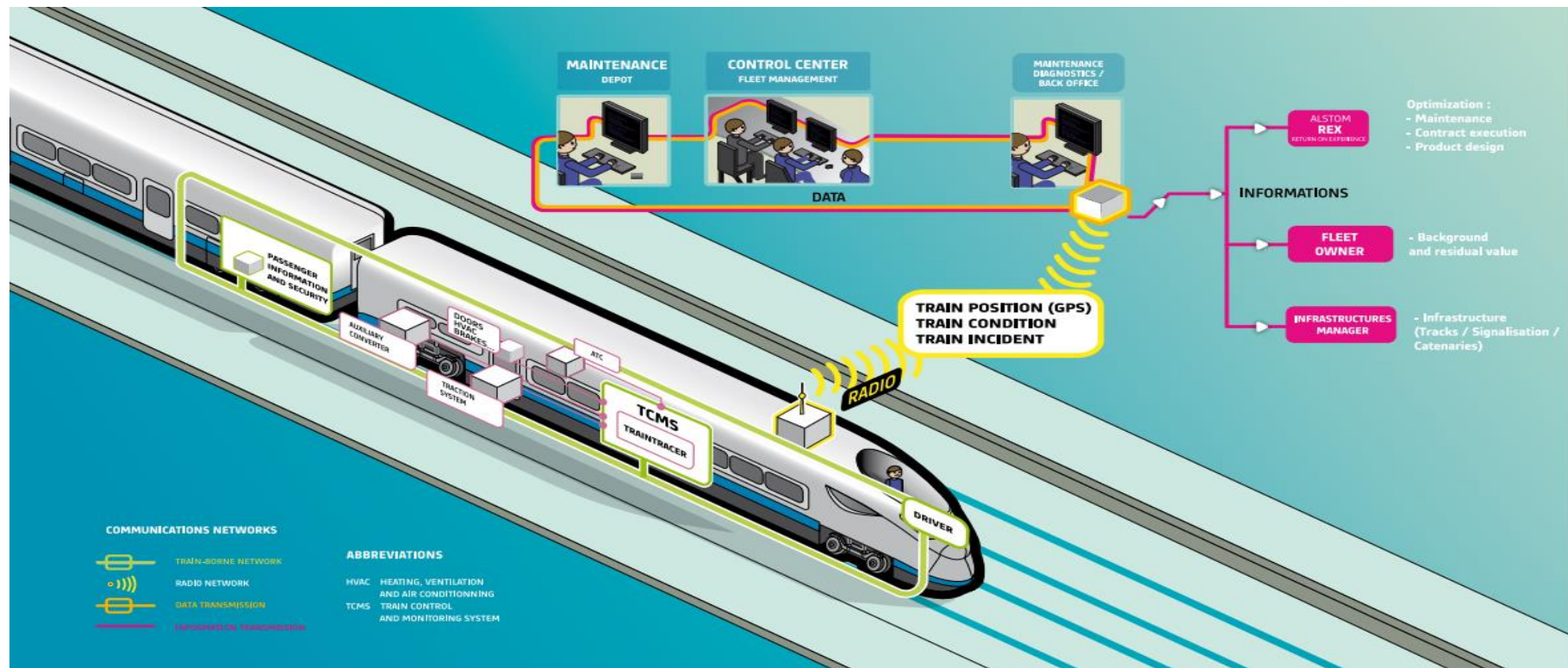


Information on the health of the asset

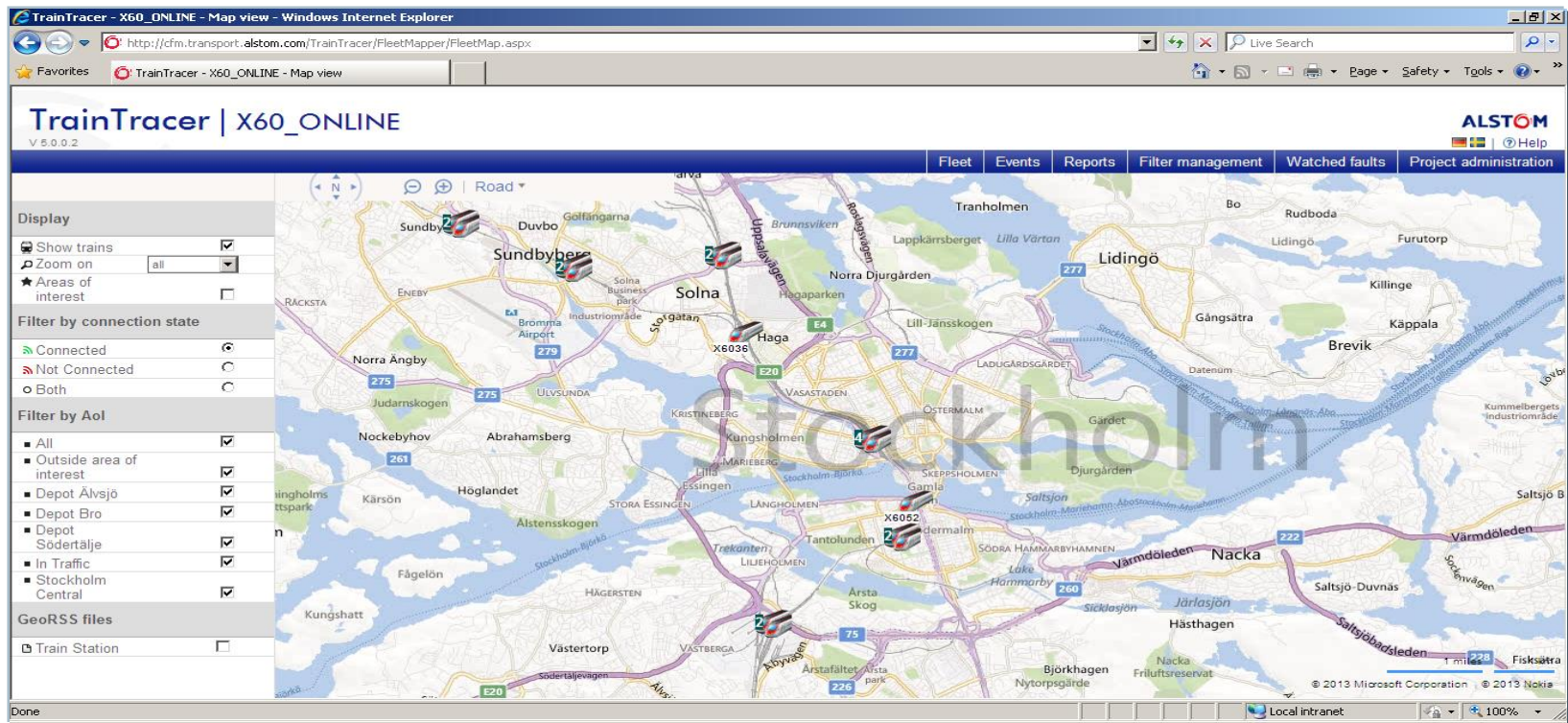
Know-How Alstom



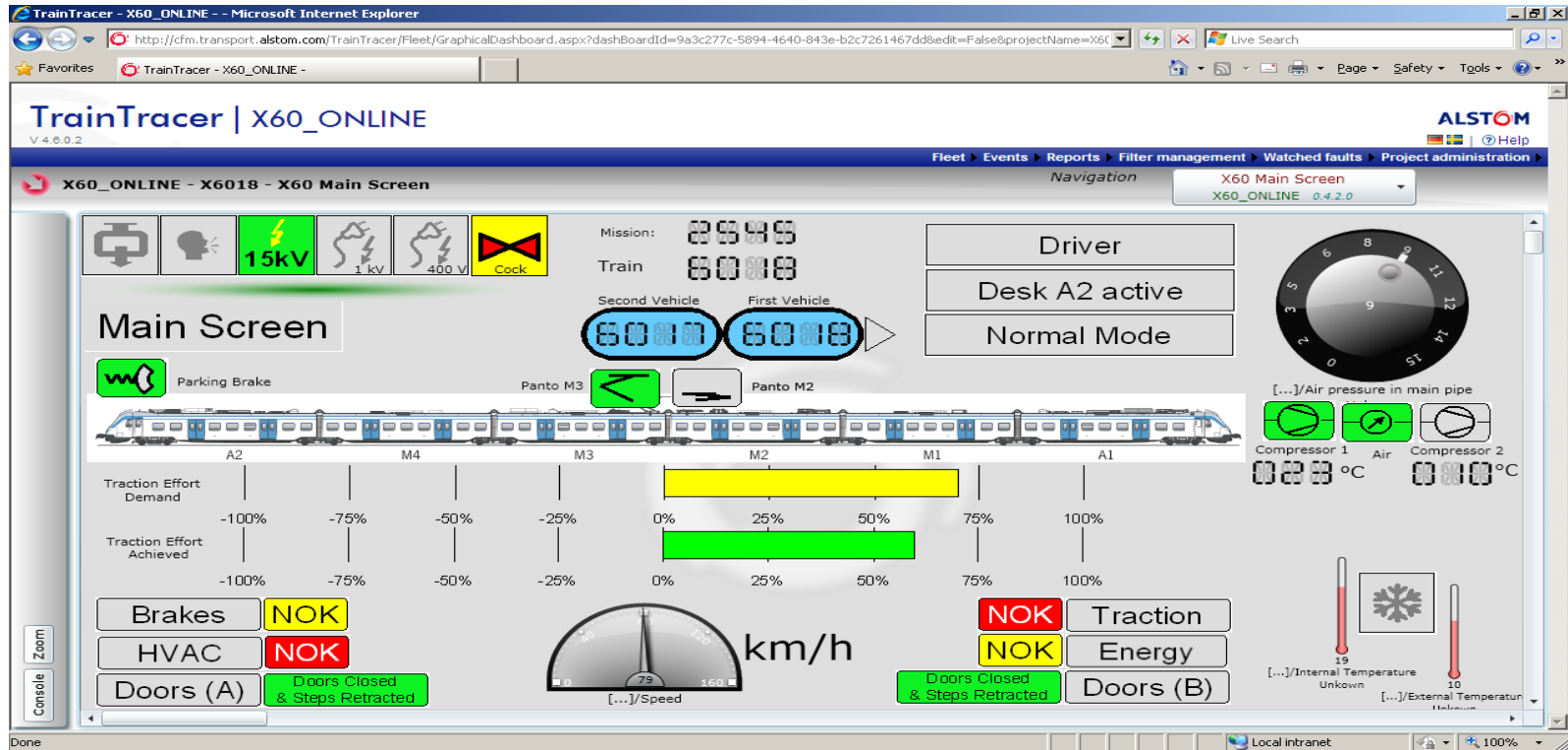
TrainTracer – real time train status and supervision



TrainTracer, Map view

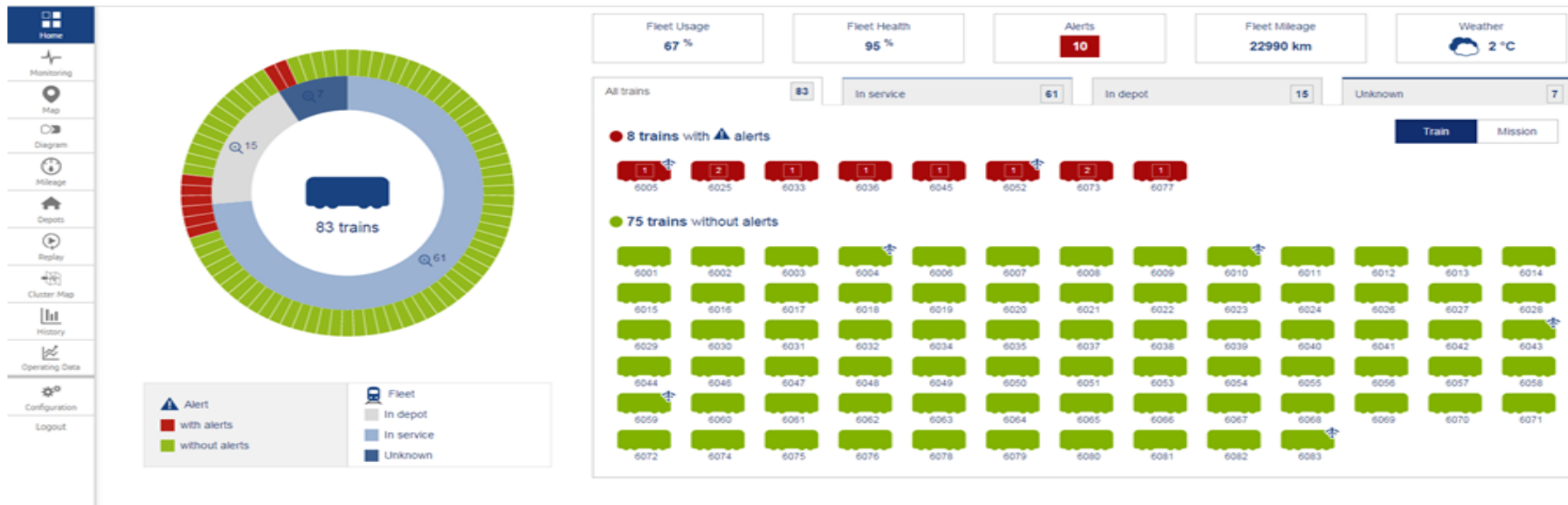


TrainTracer, Train status view



Decision support through the HealthHub platform

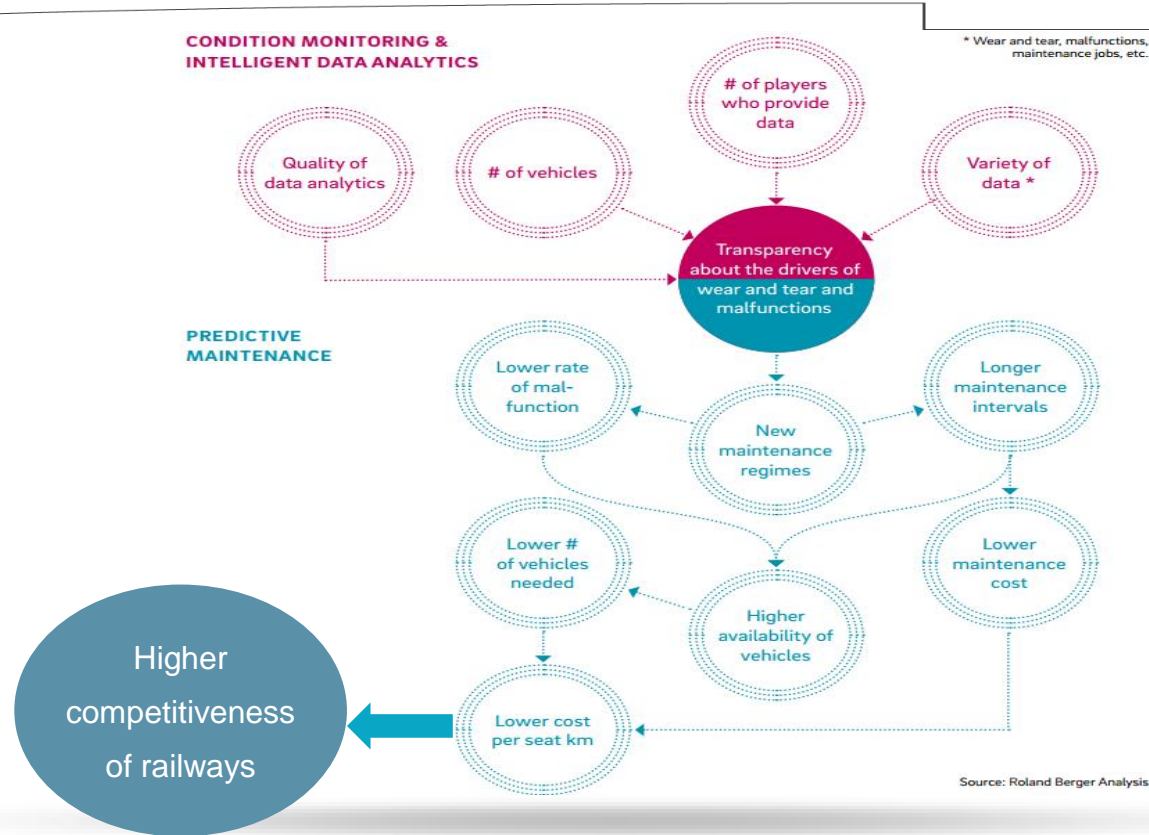
ALSTOM | Health Hub -



Decision support through the HealthHub platform



« Higher competitiveness of railways is the ultimate goal »



Alstom is a partner on this journey

Thank you!

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References



- **HealthHub platform:**

- Since 2006: WCML (Manchester), X60 (Sweden), NTV (Italia), Reims (Tramway France)
- More to come: PRASA, Ottawa, Reims, X61, X60B, Tramway of Nice, AVE, ...



- **TrainScanner:**

- Since 2015: Manchester (WCML) prototype
- More to come: rest of WCML, NTV, AMTRAK, X60, new Spanish HST, ENNO, Australia (NSW), Netherlands, Azerbaijan...



- **Motes:**

- Since 2009 on Madrid High Speed Line and Barcelona Metro & Pendolino
- Since 2012 on London Metro
- Since 2013 on Chicago and NY Metro
- Since 2014 on Switzerland Regional Train
- Since 2015 on Santiago de Chile Metro



- **TrackTracer:**

- Since 2014: Audits in Reims, Algiers, Sydney, Paris (RATP T3), Bar-le-Duc, RATP DEV Metrolink (Manchester)
- More to come:
 - Permanent installation: Reims, Sydney, PRASA, WCML, AMTRAK
 - Audits: LAM Tour, Mexico, Dubaï, Dublin, Kazakhstan, ...
 - Offers: SEMITAN (Nantes), NSW Australia, Metro Dubaï, Grand Paris, Network Rail, Morocco, HS2, Ireland, ...



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