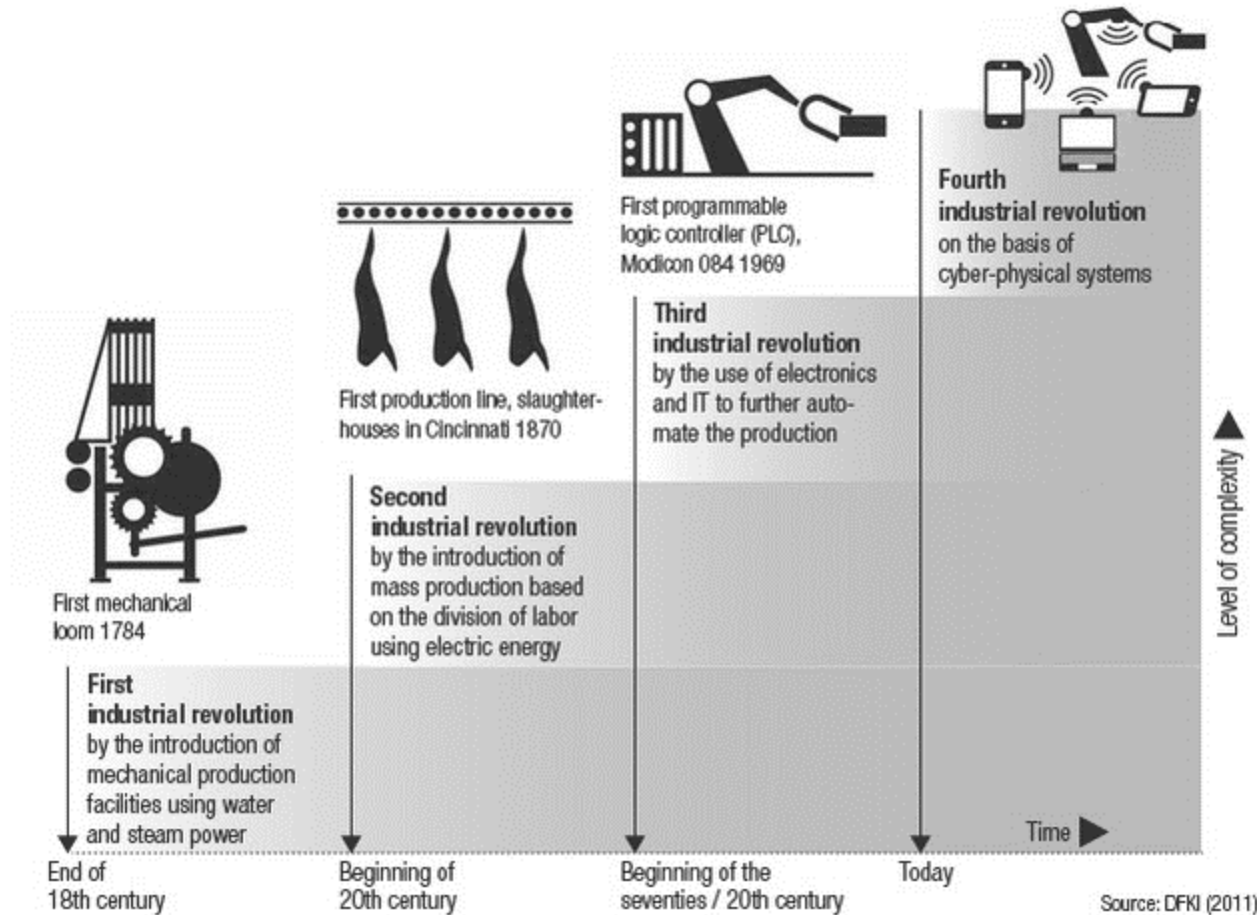


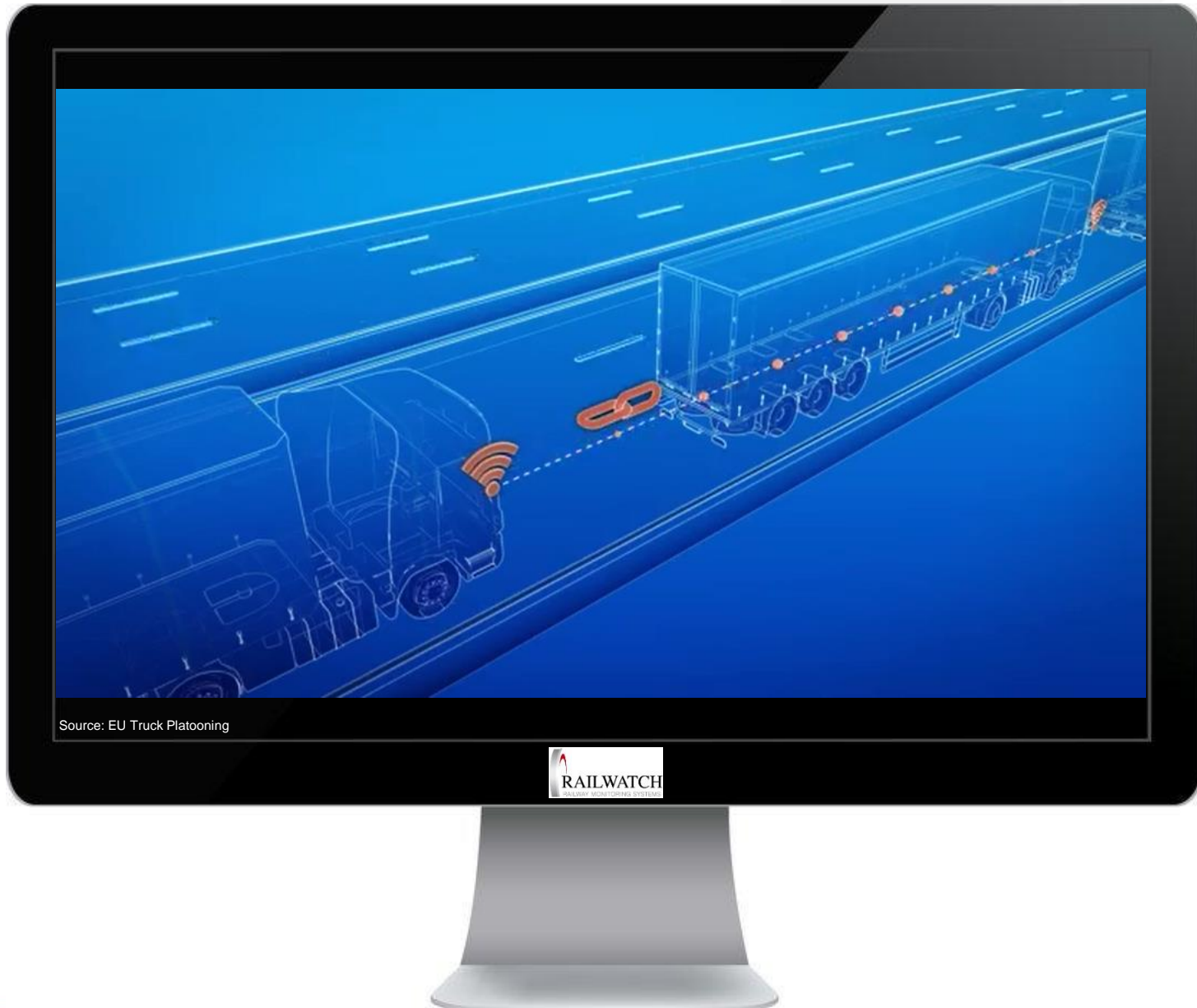


Digitisation: Revolution, Evolution or Hype? **An outlook on digitisation in rail freight transport.**

The railway

... on track to Industry 4.0

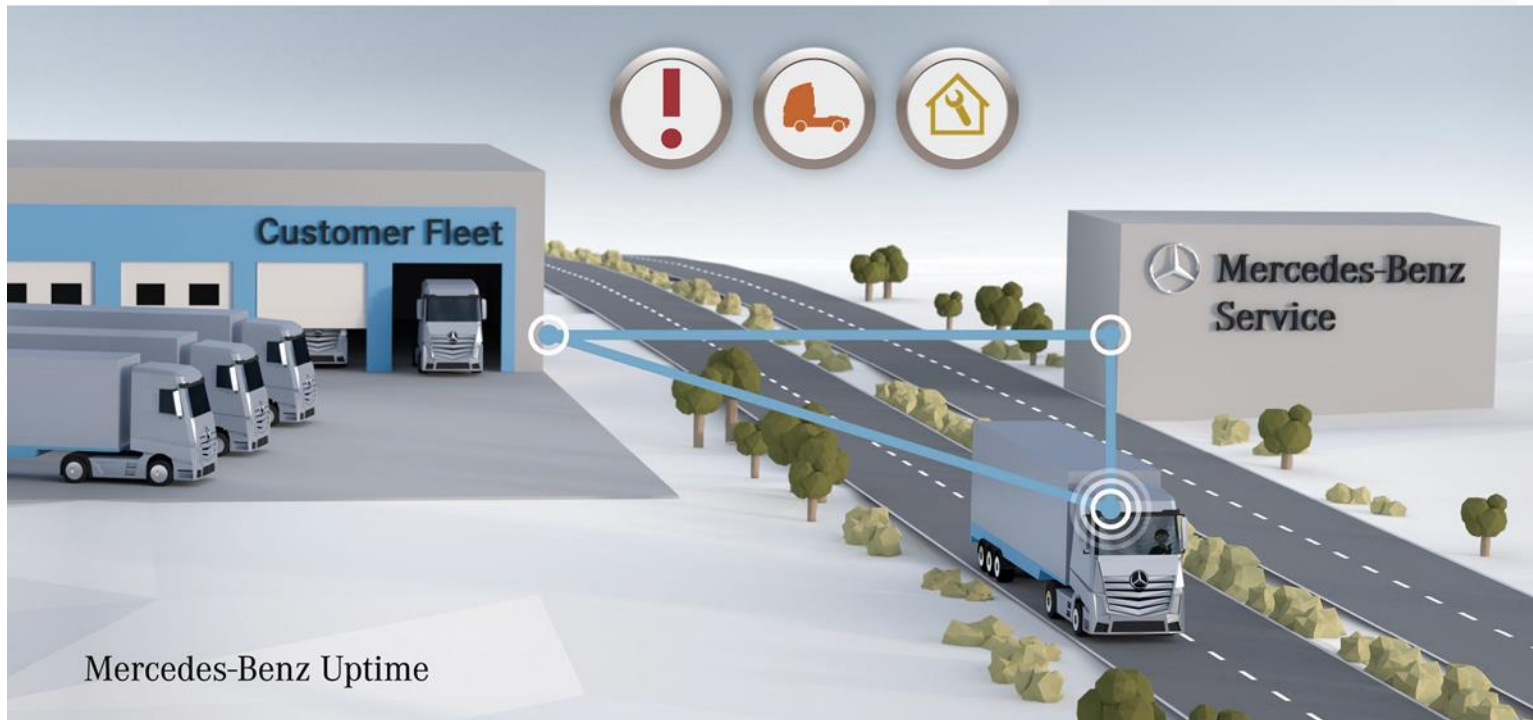




Source: EU Truck Platooning

Rail freight transport

... on track to Industry 4.0



Source: Mercedes-Benz Uptime



Rail freight transport

... on track to Industry 4.0

Where are we today:

This is how much a wagon owner knows about his wagon during the operation ...

Thus we require a comprehensive maintenance system



VPI
VERBAND DER GÜTERWAGENHALTER IN DEUTSCHLAND E. V.

HOME // VERBANDSSERVICE > INSTANDHALTUNGSLEITFADEN > MODULE

MODUL, UMFASSEND, AKTUELL

ALLE MODULE DES VPI-LEITFADENS AUF EINEN BLICK

Modul	Benennung	Stand	Letzte Änderung mit
VPI E	Einführungshinweise	01.06.2013	Update 3.01
VPI 01	Allgemeiner Teil	01.01.2013	3. Ausgabe
VPI 02	Untergestelle, Drehgestelle	15.10.2013	3. Ausgabe
VPI 03	Fahrzeugaufbauten, Tanks	01.02.2008	2. Ausgabe
VPI 04	Radsätze	01.07.2012	3. Ausgabe
VPI 05	Federn	01.03.2014	3. Ausgabe
VPI 06A	Zugleinrichtungen	01.02.2008	2. Ausgabe
VPI 06B	Stoßeinrichtungen	01.03.2015	3. Ausgabe
VPI 07	Bremsen	01.03.2010	Update 2.3
VPI 08	Elektronischer Datenaustausch	20.02.2016	Update 3.1
VPI 09	Zerstörungsfreie Prüfung	01.07.2015	Update 3.1

... with wide-ranging safety

... where many safety margins are to be considered, there are also inefficiencies.

Rail freight transport

... on track to Industry 4.0

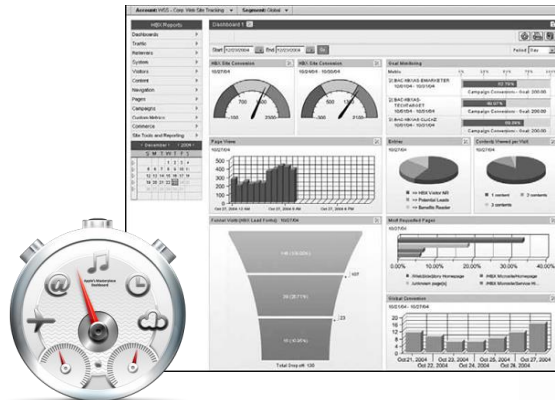
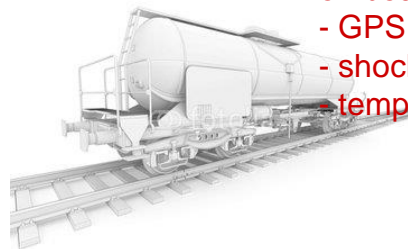
Product



Smart Product

One of the basic ideas of Industry 4.0 is to fit the products out with embedded systems that are able to gather data,...

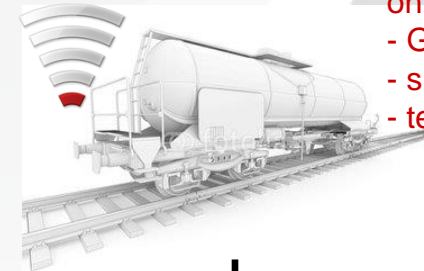
on board:
- GPS
- shock/impact
- temperature



Smart Connected Product

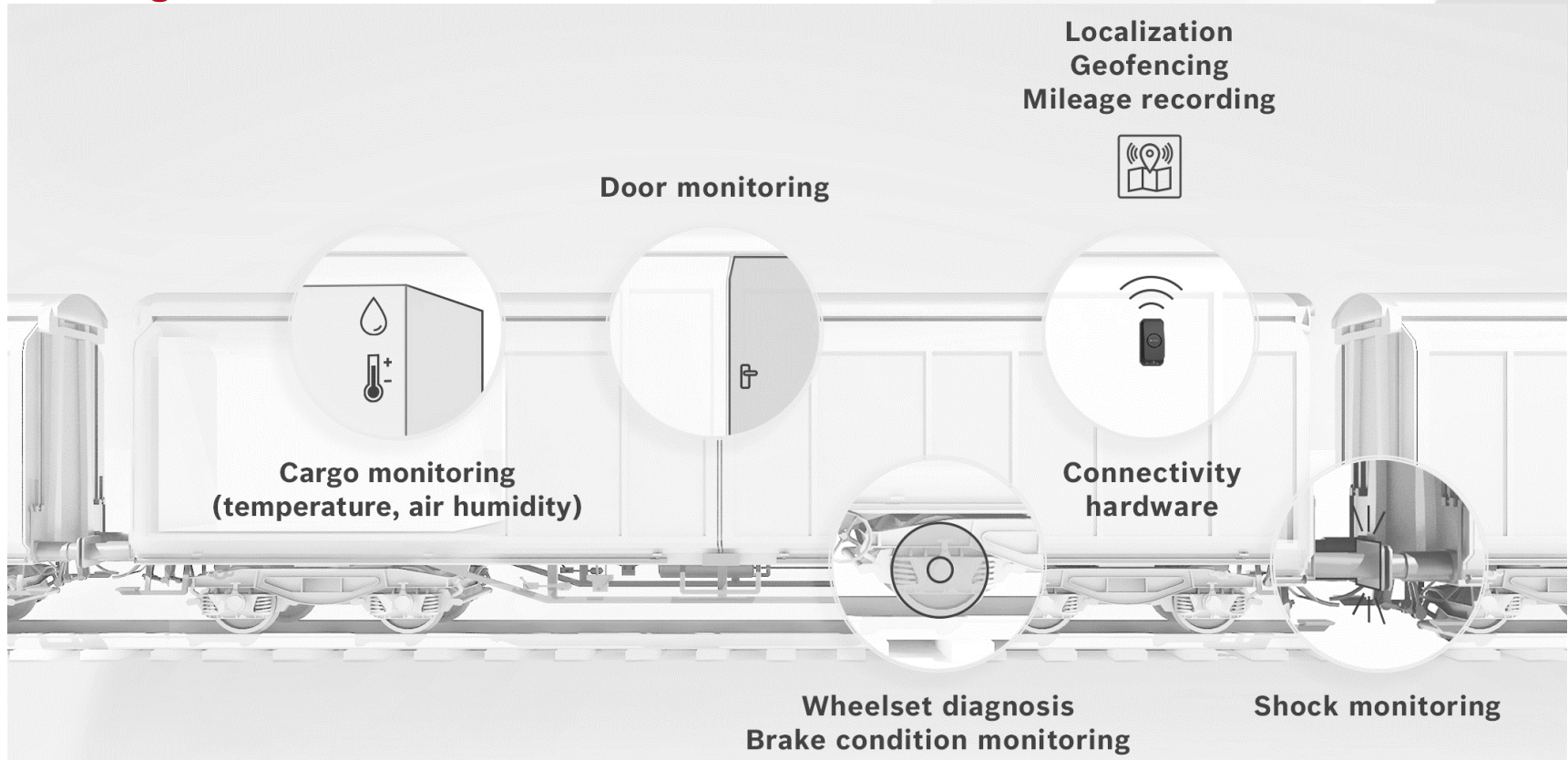
...to communicate and to network..

on board:
- GPS
- shock/impact
- temperature



So-called asset intelligence is to help, render the system more efficient

... taking stock ...



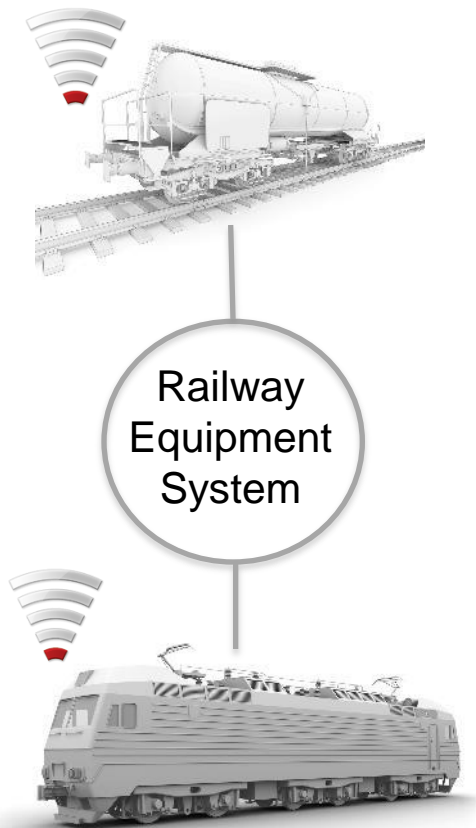
Source: Bosch Engineering

... asset monitoring geared to the needs of logistics!
... maintenance was not much in the focus thus far!

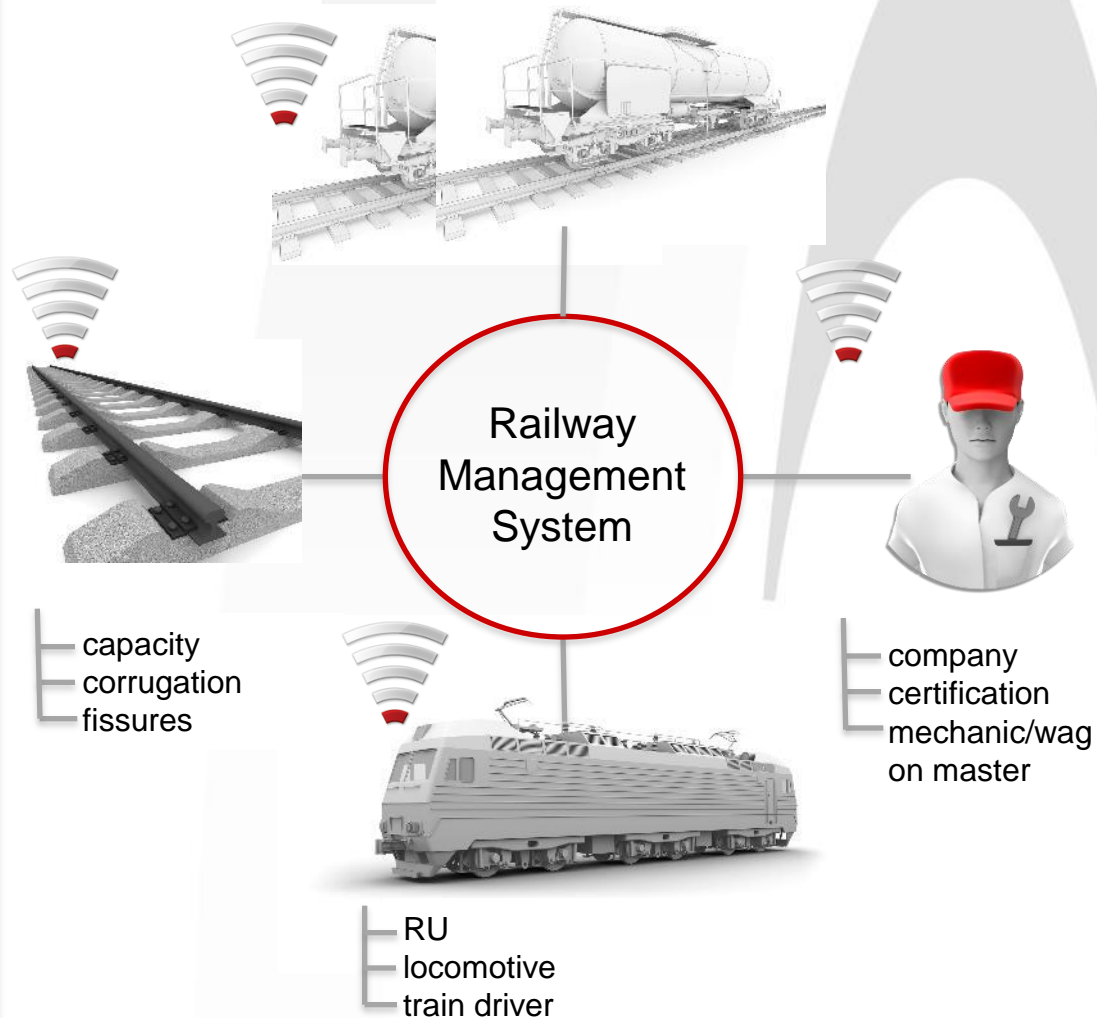
Rail freight transport

... on track to Industry 4.0

Product System



System of Systems



Retrofitting of sensors

... no easy task!



Bild: VTG Rail Europe GmbH

Limiting factors

- Lack of power on the wagon for comprehensive monitoring tools.
- Lack of user models or evidence: “It all works fine the way it is!”
- Lack of imagination: “What use is Big Data to my company?”
- Discouraging cost, especially with regard to the existing fleet?
- Theft

Deductions from the route profile for the maintenance requirements is not bad!



...but I still don't know the exact wear and tear...

Source: <http://europetrain.uic.org>

Manual trending

... takes a lot of effort

Using the example of brake blocks

Point of departure	Destination	Avg. wear of the brake blocks	Avg. mileage	Avg. wear per 1,000km
A	B	20mm	28,000 km	0.714mm
A	C	23mm	31,000 km	0.741mm
A	D	7mm	12,000 km	0.583mm
F	B	20mm	44,000 km	0.452mm
		on average	28,750 km	0.623mm

Source: VTG Rail Europe GmbH

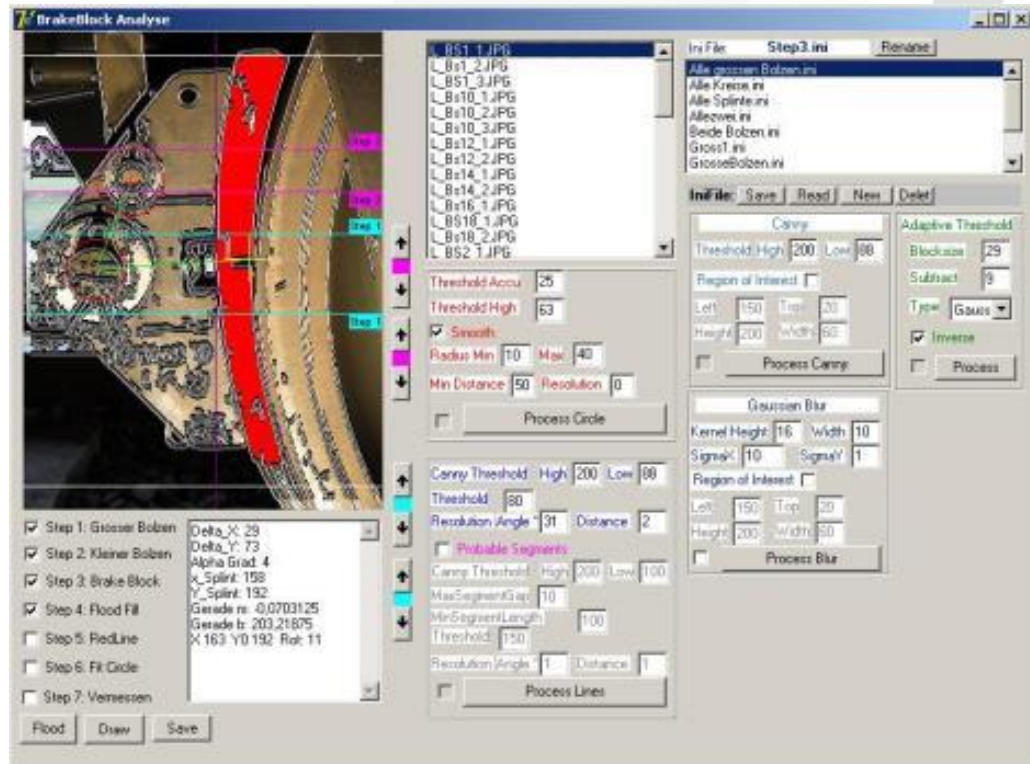
... There is the wish to know more and in a simpler way about the wear and tear of the relevant components.

The solution

... intelligent registering of critical components on rail freight wagons

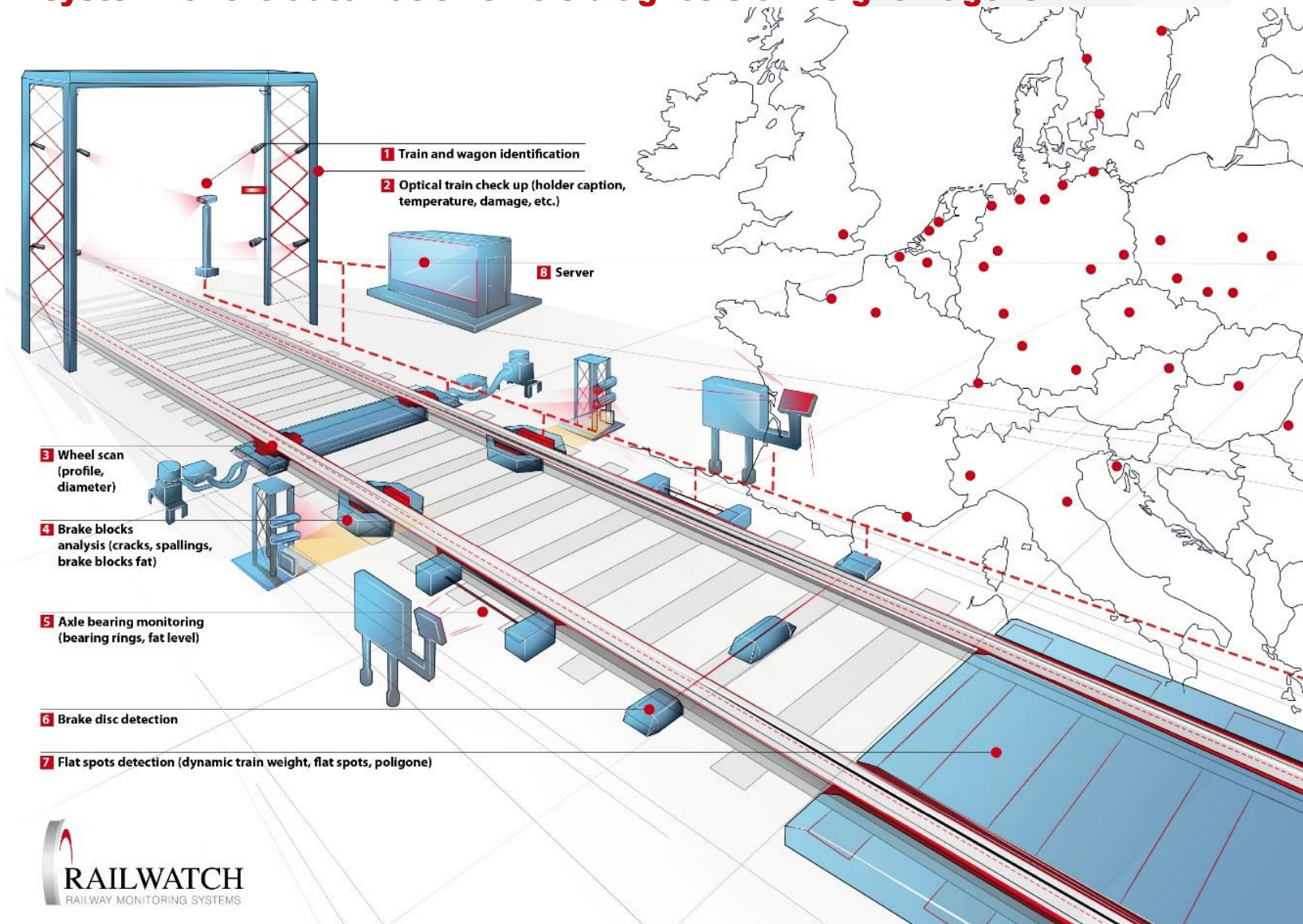
...using the example of brake blocks:

- Upon passing, the camera registers the **wagon number or QR code** with the wagon identification
- Upon passing, the camera takes photos of the brake blocks per wheel and **identifies the best photo using a set of characteristics.**
- Subsequently, the brake block is assessed using **area integrals and irregularities of the surface.**



RailWatch

A system for the automatic vehicle diagnosis of freight wagons

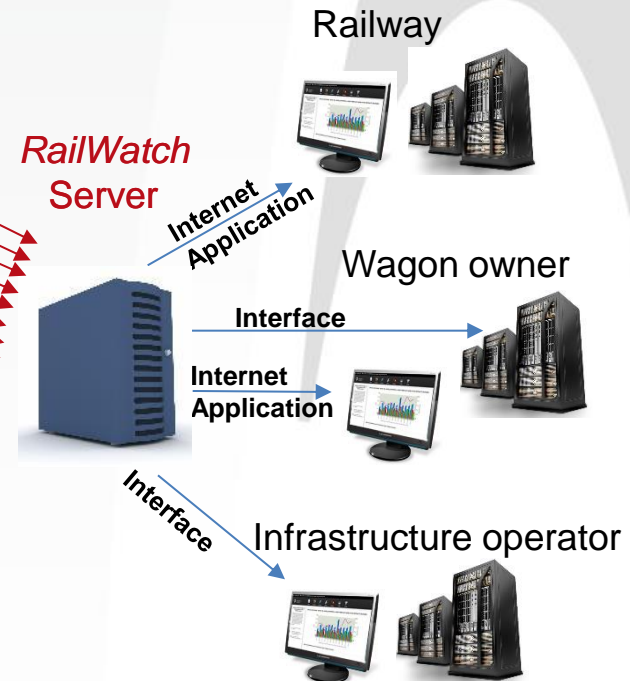
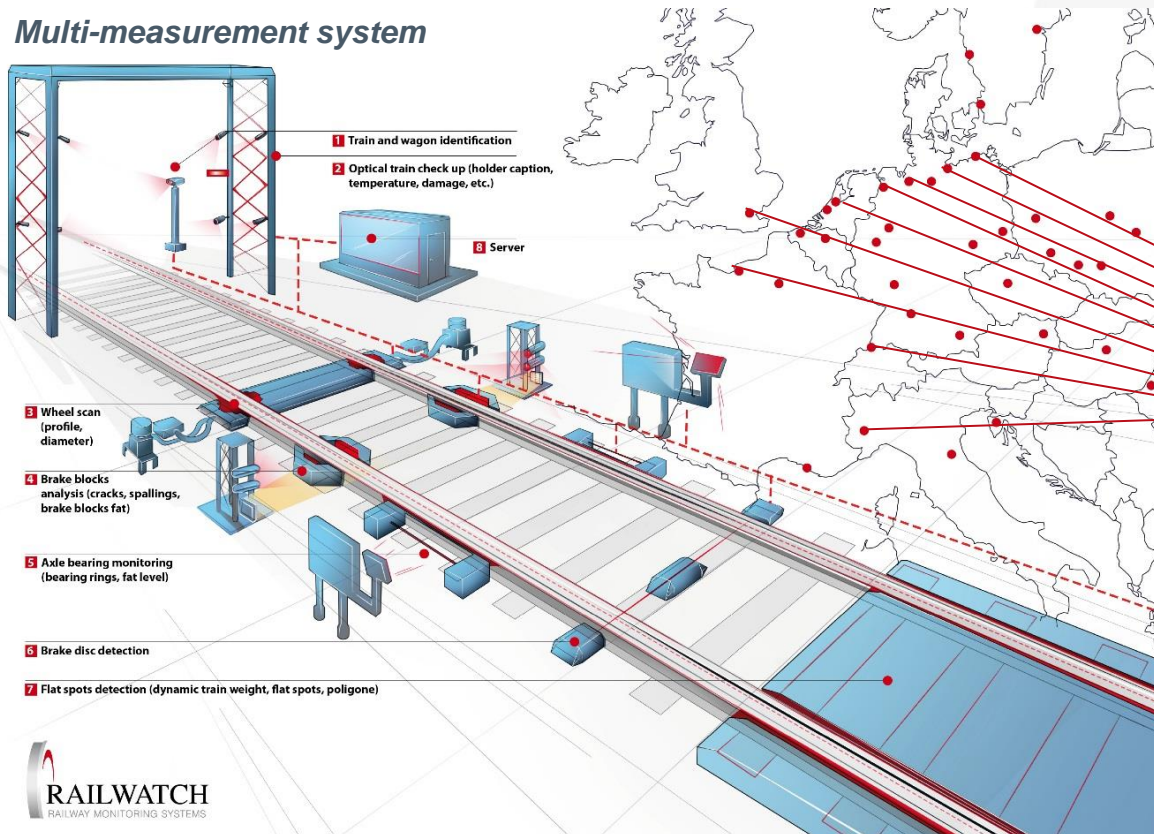


The service

Registering the condition of the components upon the passage of the train.
Processing of the information at the local server stations and transmission of the required (determined by customer) limiting measures and damage with a photo to the *RailWatch* server.

Processing of the information from the server station and transmission (interface) to the customer or storage in a web application.

Multi-measurement system



The Internet for wagon owners

RailWatch DE EN OVERVIEW

www.cgi-iot.com/railwatch/#/overview

Warnung Prozeduren

● Good conditions
● Forecast failure
● Failure

OVERVIEW

Status	Wagon Icon	ID	Location	Direction	Time	Alert	Action
🔴		36 51 825 8 724-8	Kaiserhafen	➡	16.3.2017 02:29:20	○	+
🔴		97 85 987 8 976-9	Imsumer Deich / Weddewarder Tief	➡	14.3.2017 04:46:16	○	+
🟡		61 80 530 4 677-8	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		78 54 984 1 720-7	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		39 99 471 3 667-0	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		22 93 790 7 114-4	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		22 62 736 9 240-3	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		24 87 764 3 853-3	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		43 75 064 7 559-3	Kaiserhafen	➡	12.3.2017 13:51:57	○	+
🟡		26 95 972 4 204-1	Kaiserhafen	➡	12.3.2017 13:51:57	○	+

ASSIGMENTS

none


NO ITEMS

Savings this month **2.319€**

The Internet for wagon owners


RailWatch
www.cgi-iot.com/railwatch/#/trainDetail/100

RAILWATCH DE EN
Overview ▶ TRAIN TAWUKCHQ



ENGINE INFORMATION

TX Logistik
Standing: 12.3.2017 13:51:57




Train number: TAWUKCHQ
Number of wagons: 10
Station: Kaiserhafen

TRAIN FORMATION DETAIL

Type	1 Month	2 Month	3 Month
61 80 530 4 677-8			
78 54 984 1 720-7			
39 99 471 3 667-0			
22 93 790 7 114-4			

Wagon



Wagon number 61 80 530 4 677-8	Failure (10mm) 24.03.2017
Wagon class Intermodal wagon	Warning Limit (16mm) 15.02.2017

WHEEL SET 1	
Warning / Failure 17.02.2017 / 31.03.2017 Anomaly : No / Unsymmetrical : No	
WHEEL SET 2	
Warning / Failure 15.02.2017 / 24.03.2017 Anomaly : No / Unsymmetrical : No	
WHEEL SET 3	
Warning / Failure 15.02.2017 / 26.03.2017 Anomaly : No / Unsymmetrical : No	
WHEEL SET 4	
Warning / Failure 16.02.2017 / 28.03.2017 Anomaly : No / Unsymmetrical : No	

ASSIGNMENTS

1 Pending

- Train TAWUKCHQ
- Wagon 61 80 530 4 677-8
- Train CFGAPFZX

CONTINUE TO EDIT ▶

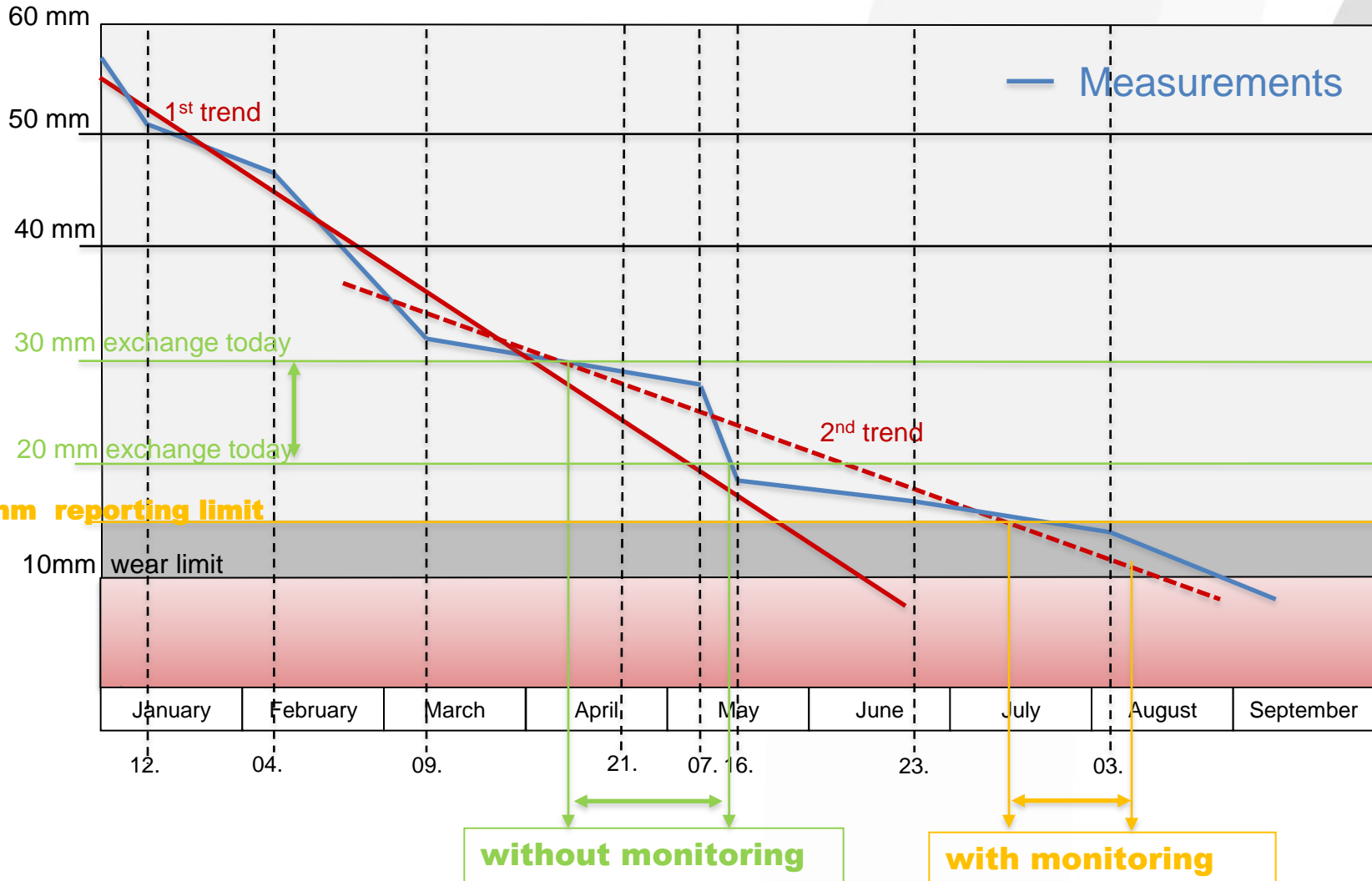
← Back

Savings this month **2.319€**

The significant added value

.... the wear trend analysis of RailWatch

Explained using the wear trend example of a 60mm plastic brake block



The data model

... the 3 product groups (excerpt)

Freight wagon owners

Railway undertakings

Railway infrastructure companies

Maintenance according to condition

Time saving in train dispatching

Increasing safety & productivity, remuneration system

Informationsdienst Güterwagenhalter - Änderungen vorbehalten

Gruppe	Code	Informationstyp	Inhalt	Maß/Format	
Radreifen/Vollrad		Flachstellen	Länge, links/rechts	mm	
		Polygone	Unrundheit, links/rechts	mm	
		Radprofil	Spurmaß (SR)	mm	
		Radprofil	Abstand der inneren Stirnfläche (AR)	mm	
		Radprofil	Radreifen-/Radkranzbreite (BR), links/rechts	mm	
		Radprofil	Spurkranzdicke (Sd), links/rechts	mm	
		Radprofil	Spurkranzhöhe (Sh), links/rechts	mm	
		Radprofil	Dicke des Radreifens in Maßkreisebene	mm	
		Radprofil	Spurkranzflankenmaß (qR), links/rechts	mm	
		Radprofil	Hohllauf, links/rechts	mm	
		Rad Durchmesser	Durchmesser, links/rechts	mm	
	Bremssohlen		Bremssohlen	Breite oben	mm
			Bremssohlen	Breite mitte	mm
			Bremssohlen	Breite unten	mm
		Bremssohlen	Ausbröckelung	mm²	
		Bremssohlen	Risse	mm²	
		Bremssohlen	Foto	jpg/tif	
Achslager			Achslager	Anomalie, Lepterringe, (potenzieller) Defekt	Ja/Nein
		Achslager	Fettfüllstand zu hoch	Ja/Nein	
		Achslager	Fettfüllstand zu niedrig	Ja/Nein	
		Achslager	Fettfüllstand zu niedrig	Ja/Nein	
Wagenbeschriftung		fehlen, nicht lesbar	Wagennummer	Ja, jpg./tif	
		fehlen, nicht lesbar	Zeichen „RIV“ oder ein Zeichen der Zul	Ja, iso./tif	

incl. GPS for maintenance

AVV Produkte - Änderungen vorbehalten -

Bauteile	Code	Mängel/Kriterium/Hinweise	Bemerkung
1.1. Radreifen	1.1.1	Dicke weniger als ... für 120km/h zugelassen Wagen (Wagen die das Zeilc	
	1.1.1	Dicke weniger als ... übrige Wagen 30mm	
	1.1.2	Radreifen, gebrochen	Verifizierung
	1.1.3	Radreifen löst, unruher Klang	Verifizierung
	1.1.5	Radreifen seitliche Verschieben, Sprengring lose oder sichtbar	Verifizierung
	1.1.6	Schaden am Sprengring (gerissen / gebrochen / fehlt)	Verifizierung
1.2. Vollrad	1.2.1	Die Rille zur Kennzeichnung der Mindestdicke ist nicht mehr über ihren g	
	1.2.2	Thermische Überbeanspruchung durch die Bremse, Angeschmolzene Br	
	1.2.3	Thermische Überbeanspruchung durch die Bremse, Beschädigung der L	
	1.2.2.1	Angeschmolzene Bremssohlen oder Beschädigung der Lauffläche mit IV	
	1.2.2.2	Angeschmolzene Bremssohlen oder Beschädigung der Lauffläche mit IV	Verifizierung
	1.3. Radreifen	1.3.1.1	Breite B > 139 mm und ≤ 140 mm
1.3.1.2		Breite B > 140 mm, < 133 mm bei Vorhandensein einer Überwabung S	
1.3.2		Lauffläche stellenweise eingedrückt, ungleichmäßige Kontaktflächen ode	
1.3.3.1		Flachstellen Rad-Ø ≥ 630 mm und Flachstellen mit einer Länge von > 60	
1.3.3.2		Flachstellen Rad-Ø < 630 mm und Flachstellen mit einer Länge von > 30	
1.3.4.1		Rad-Ø ≥ 630 mm und Materialauflagerungen mit einer Länge von > 60 mm	
1.3.4.2		Rad-Ø ≥ 630 mm und Materialauflagerungen mit einer Länge von > 10mm	
1.3.4.3		Rad-Ø ≥ 630 mm und Materialauflagerungen mit einer Länge von > 30 mm	
1.3.4.4		Rad-Ø ≥ 630 mm und Materialauflagerungen mit einer Länge von > 10 mm	
1.3.4.5		Locher, Ausbröckelungen oder Ablätterungen an der Lauffläche mit ein	
1.4. Spurkranz	1.4.1	Spurkranzhöhe Sh größer als 36 mm, Lauffläche des Rades eingelaufen	
	1.4.2	Dicke des Spurkranzes Sd, Rad-Ø ≥ 840 mm Sd < 22 mm Verifizierung	

Informationsdienst Güterwagenhalter - Änderungen vorbehalten

Gruppe	Code	Informationstyp	Inhalt	Maß/Format
Nebenprodukte		Wagengewicht	Gewicht	kg
Nebenprodukte		Wagennummer	UIC.Wagennummer	UIC.Wagenr.
Nebenprodukte		Länge	Länge	m
Nebenprodukte		Ladungsnummer	Containernummer (n)	Containernu.
Nebenprodukte		Lärm	Lärmmission (interpoliert)	dB(A)
Nebenprodukte		Bremssohle	K-Sohle / Grauguss-Sohle	K./S.

via mobile data transmission

Products

WagonScan

... per component on wagon
... as monthly flat fee

TrainScan

... per train passage (flexible booking)
... as individual price or flat rate

Terminal-RailGate

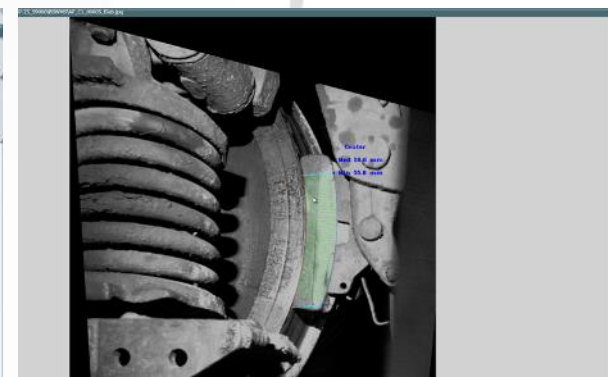
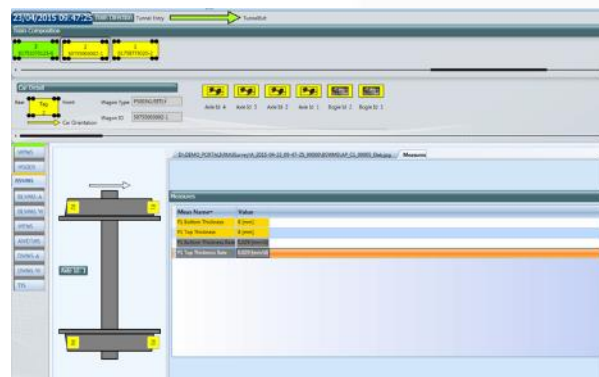
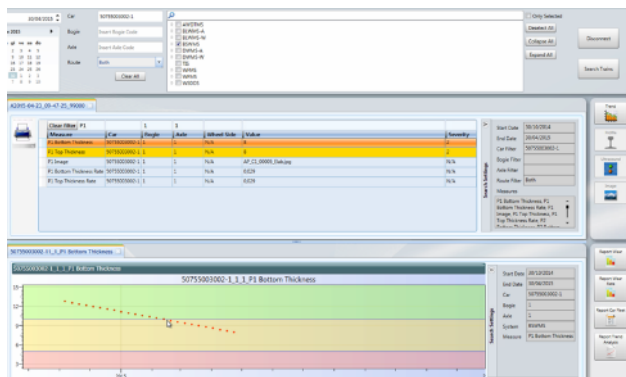
... 100% registration
... 99% availability
... rental or purchase

Advantages

for freight wagon owners

... reducing the maintenance cost & increasing the availability

- **Avoiding additional cost** through a preventative maintenance management. *No reaction but taking proactive action.*
- Thus, **avoiding unplanned wagon downtimes** and **augmenting the availability**. There is an increase in productivity with a simultaneous reduction in the number of required wagons.
- **Evidence pursuant to GCU on operational defects or quality defects** may be provided for the RUs, freight wagon workshops and component manufacturers.
- **Cost saving** through extension of the maintenance cycles (Life Cycle) on the basis of operational live data, which may be stochastically condensed.
- **New version** or further development of the **maintenance manual** is possible. **Know-how advantage** for the design of freight wagons, **improved components**.



Advantages

for the terminal and railway undertakings

... more safety on the infrastructure & increase of productivity

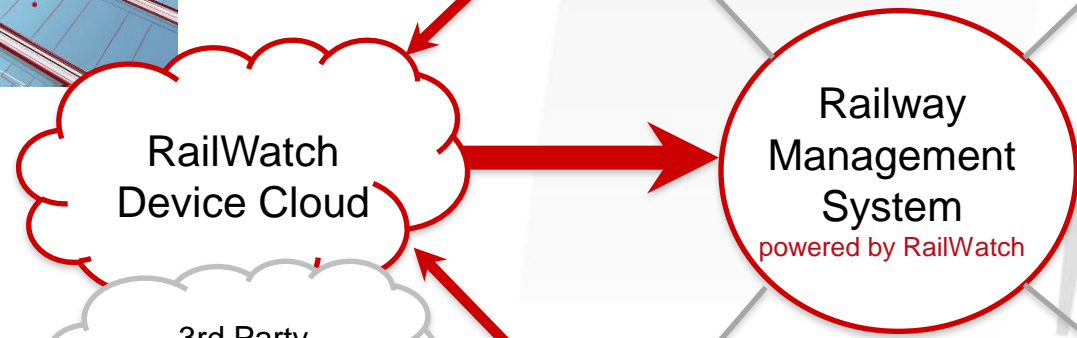
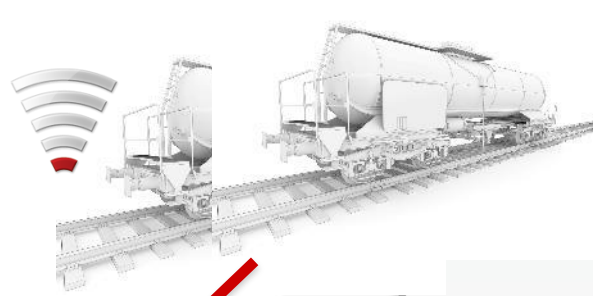
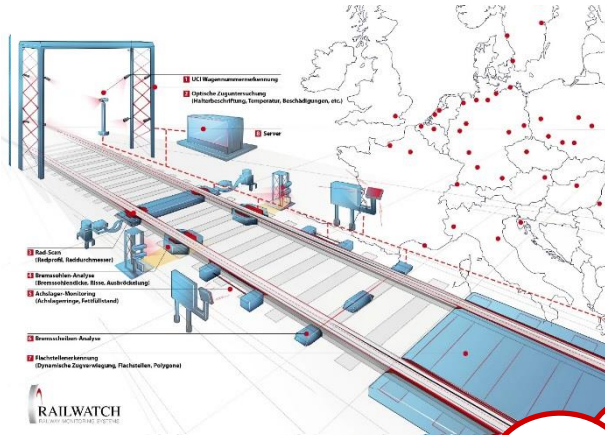
- **Identification of wagons that are unfit for operation** to avoid accidents and disruption of production on the rail infrastructure.
- **Higher productivity of the rail infrastructure**
 - through **simplification** of the **technical inspection of the wagon before the train's departure**, operational set of rules, e.g. General Contract of Use for Wagons (GCU).
 - Through early **recognition of defects** and identifying **freight wagons** unfit for operation before loading/renewed loading
- **Identification of wagons with wheel flats that cause damage to the rail surface**, possibly **holding liable** the party at fault or levying a **user charge dependent on the wear (pricing system)**.
- Check with regard to the correct levying of the **user charge**, depending on the design of the **remuneration system (wagon weight, wheel flats, etc.)**



One possibility

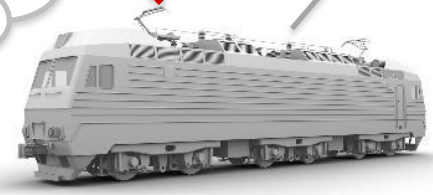
... towards digitisation

... evolution instead of revolution



company
certification
mechanic
/wagon master

- RailWatch**
- Labelling missing, illegible
 - Graffiti
 - Temperature
 - Deformations
 - Brake blocks
 - Wheel profiles & diameter
 - Axle bearing rings
 - Lubricant filling level
 - Wheel flats, polygons
 - Chipping
 - Burrs
 - Wagon weight, etc.



RU
Locomotive
train-driver
pantograph



capacity
corrugation
fissures

Advantages

for the entire railway market

... networking of the freight wagons among one another
 ... let machines talk

Automatic analysis of the cause (automatic vehicle diagnosis) with regard to

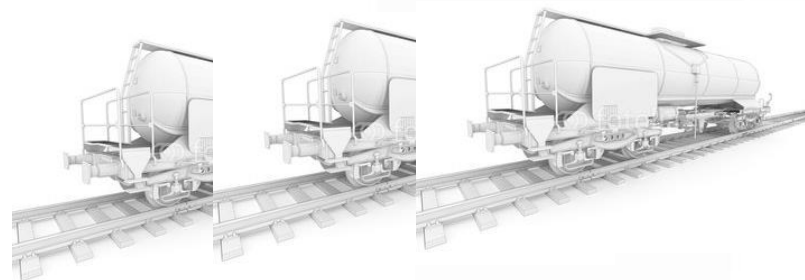
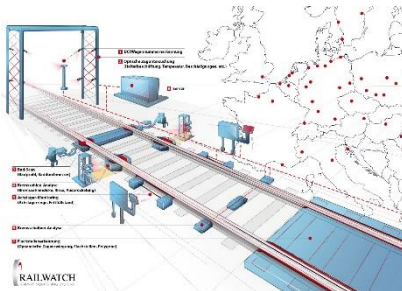
- technical vehicular problems (e.g. axle bearings)
- rail operational problems (e.g. chipping)
- infrastructural problems (e.g. polygons)

Recommendations for action

Fleet manager

...deals with the root cause of the problem.

Moving away from problem fixing towards problem solving.





Thank you very much!