The Global Language of Business

The Value Proposition for GS1 ID Keys and RFID in Rail

Transport & Logistics Workshop
GS1 Event 2015

Karl Åkerlund, Swedish Transport Administration
Seppo Mäkitupa, Liikennevirasto, Finland
12th October 2015, Warsaw

The need for monitoring

- each train of each operator will be monitored:
  - running temperatures of the axle bearings
  - defect wheels and pantographs
  - loading imbalance

- **monitoring means**
  - **fewer derailments**
  - **lower maintenance costs**
  - **more effective use of the network**

One track – many users

- Monitoring offered as a **service**

- Liikennevirasto (FTA) as the railway infrastructure manager provides the data to the railway operators

- WIN-WIN: track owner gets data about the track wear, operator gets data about its fleet

  → Result: maintenance in time, more available capacity, less severe faults, fewer disturbances, more predictability, …

Train composition – through borders

- Denmark
- Norway
- Train companies
- Industries
- Universities
- Etc…

Transaction:
Train x

Information

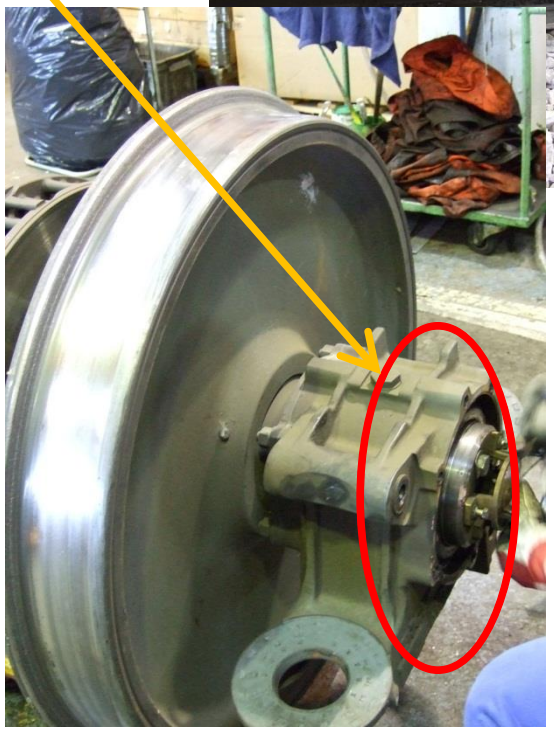
Object:
Vehicle 1
In

Object:
Vehicle 2
In

Object:
Vehicle 3
Information

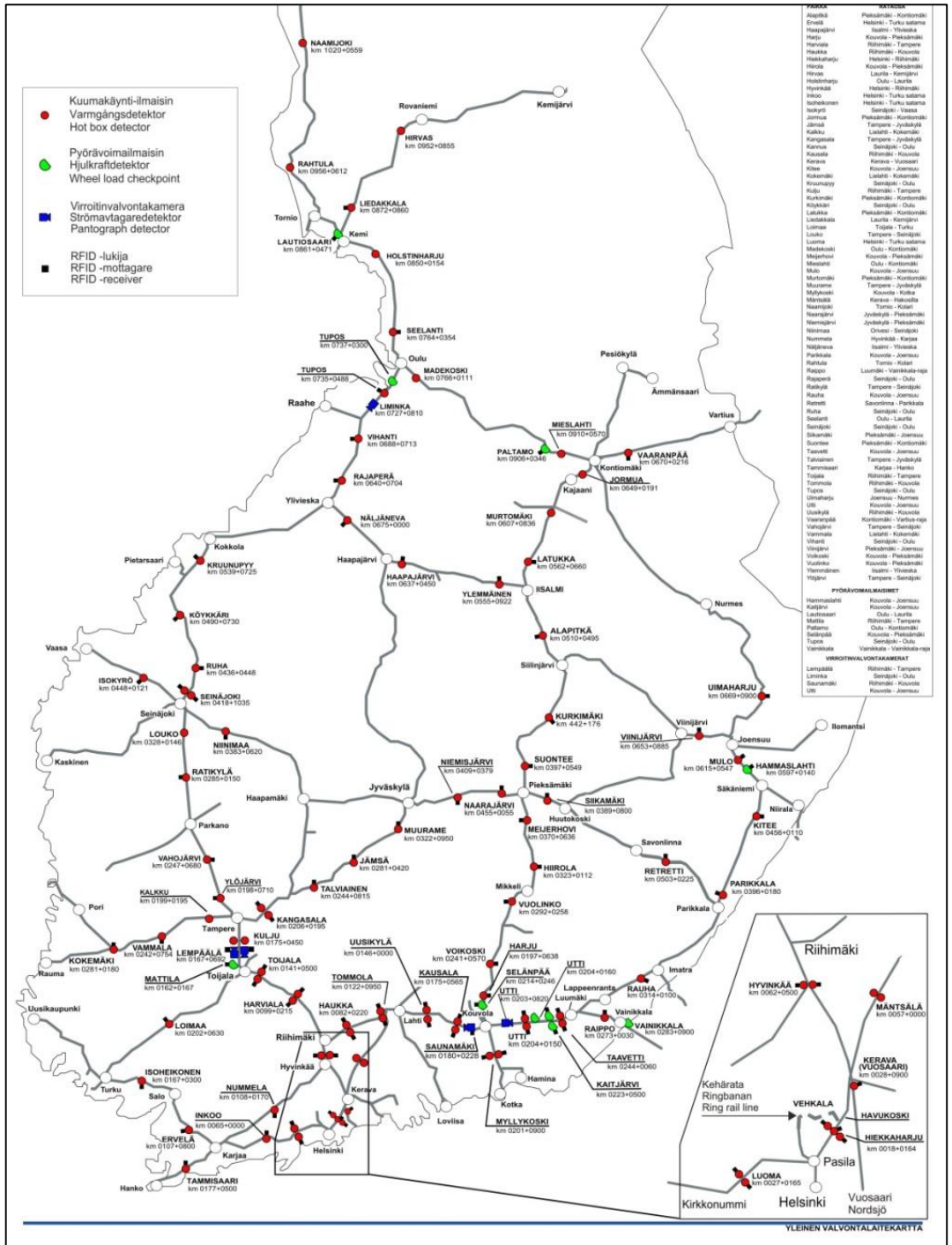
Rolling stock – Track interaction

- Track - rolling stock interfaces
  1. The wheel and the rail
  2. The pantograph and the catenary line
  3. Axle bearings



Sites Finland

Type	Qty
Hot Axle Box Detectors (HABD)	103
Pantograph Monitoring Systems (APMS)	9
Wheel Impact Load Detectors (WILD)	10
RFID Rail Reader Units (RRU)	120

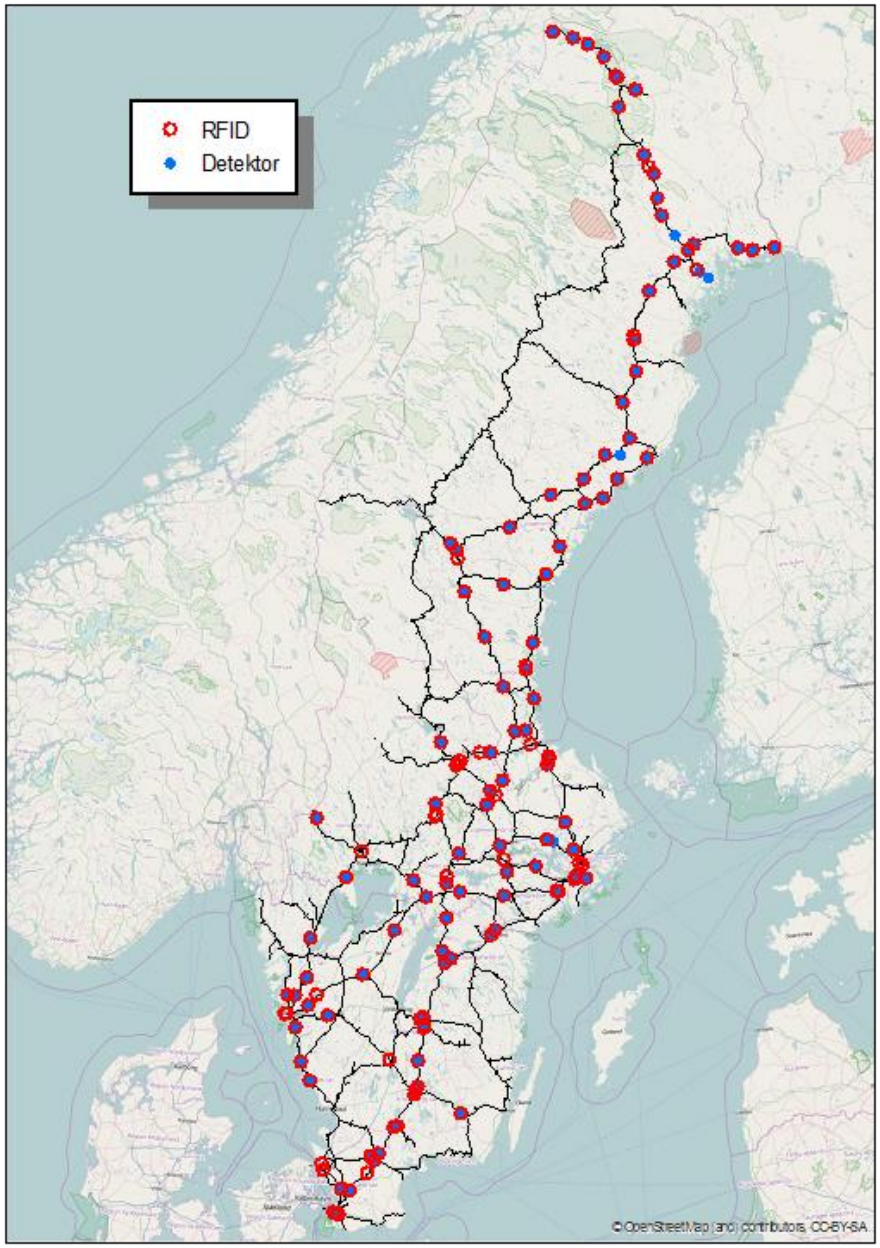


Geography Sweden

183 Read points installed
(176 matched with WTMS)

+150 planned installations -2017

> 3500 tagged vehicles



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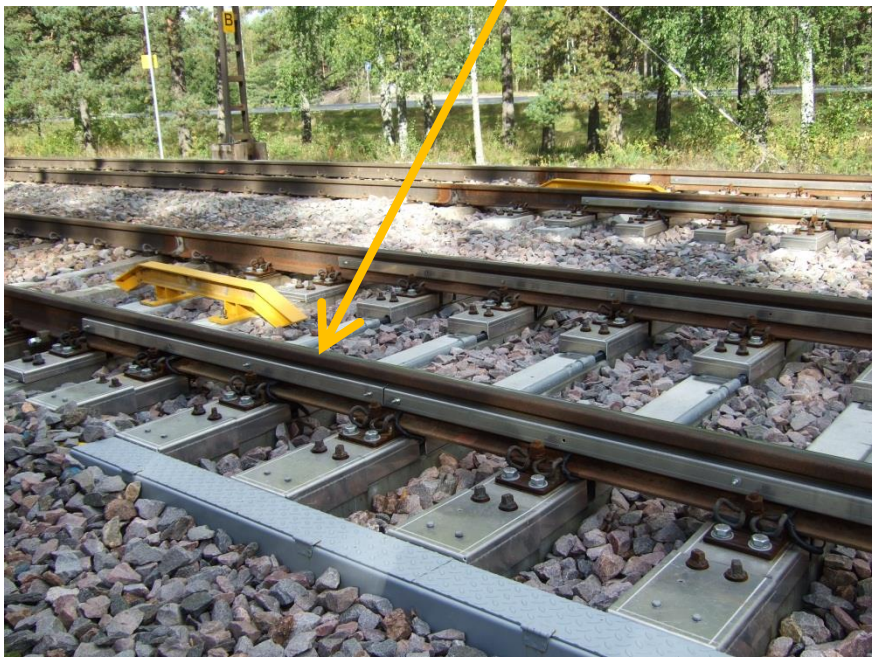
Devices Finland

- Sensys Traffic APMS II
- voestalpine Phoenix MB HABD
- Tamtron Scalex WILD



The required spice: RFID

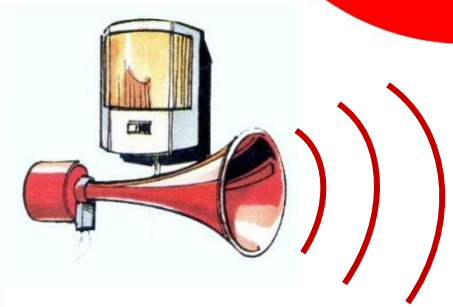
- **Data** produced by the monitoring devices is converted into **information** by adding a simple spice: **RFID**

- **Information** is provided for the train operators, <u>if their fleet carries RFID tags</u>

- prerequisites for the use of RFID are based on GS1 Guideline RFID In Rail

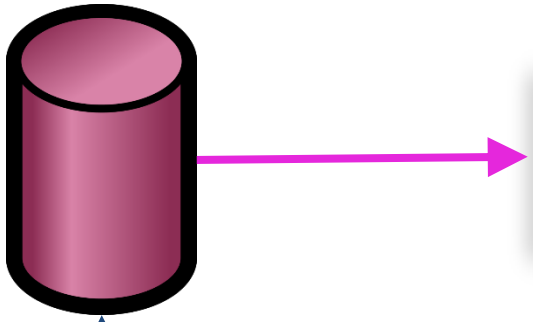
- A new, automatic centralized system **(VALTSU)** in production by the end of 2015
  - combines the monitoring data with the RFID reading
  - offers tools for analysis
  - enables tracking the defect rolling stock unit

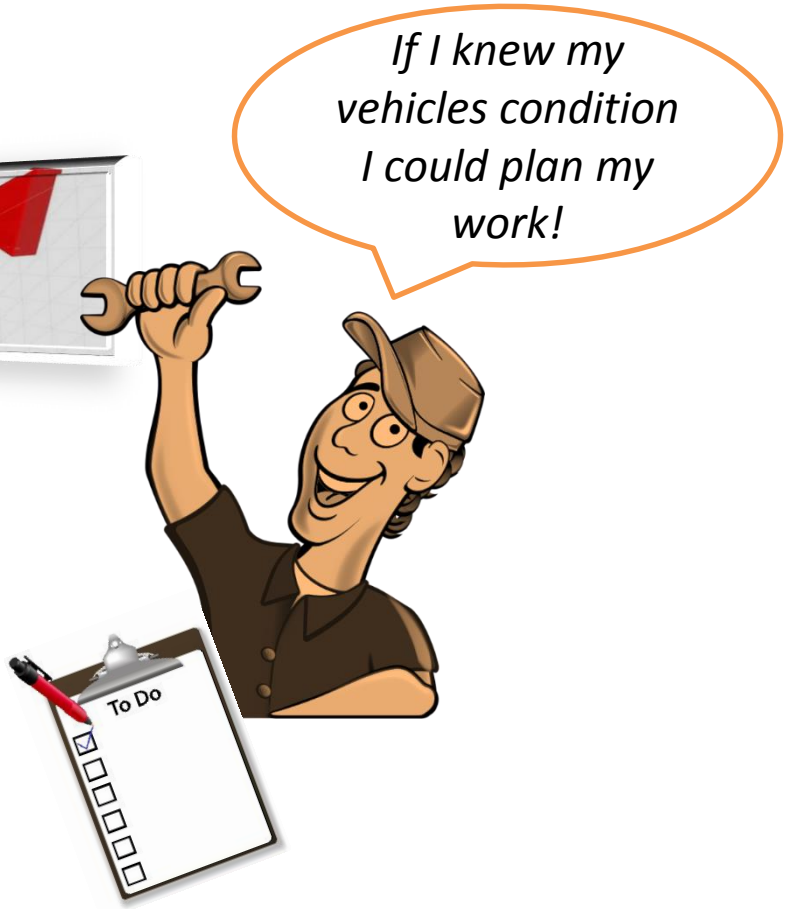
Traditional use of WTMS
(Wayside Train Monitoring systems)



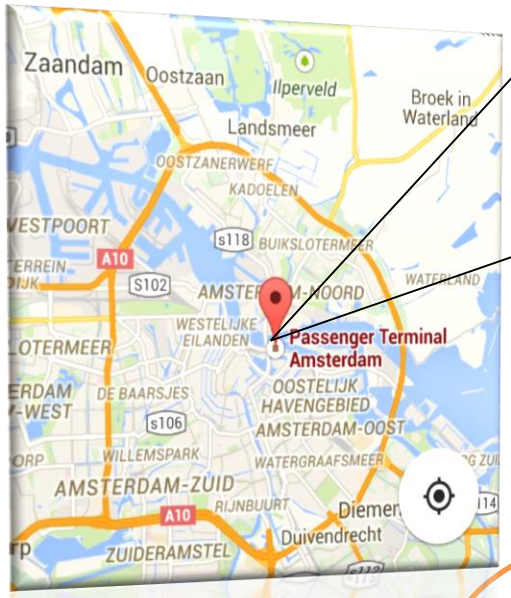
is based on actions on emergency alarms

Goals – Preventive maintenance





Goals – Track and trace



My vehicles position is vital for our business!

Why use Identification Numbers?

Identification of trains

- A train consists of wagons and a locomotive
- Wagons have numbers:
  Long ago ‘123’, now European Vehicle Number

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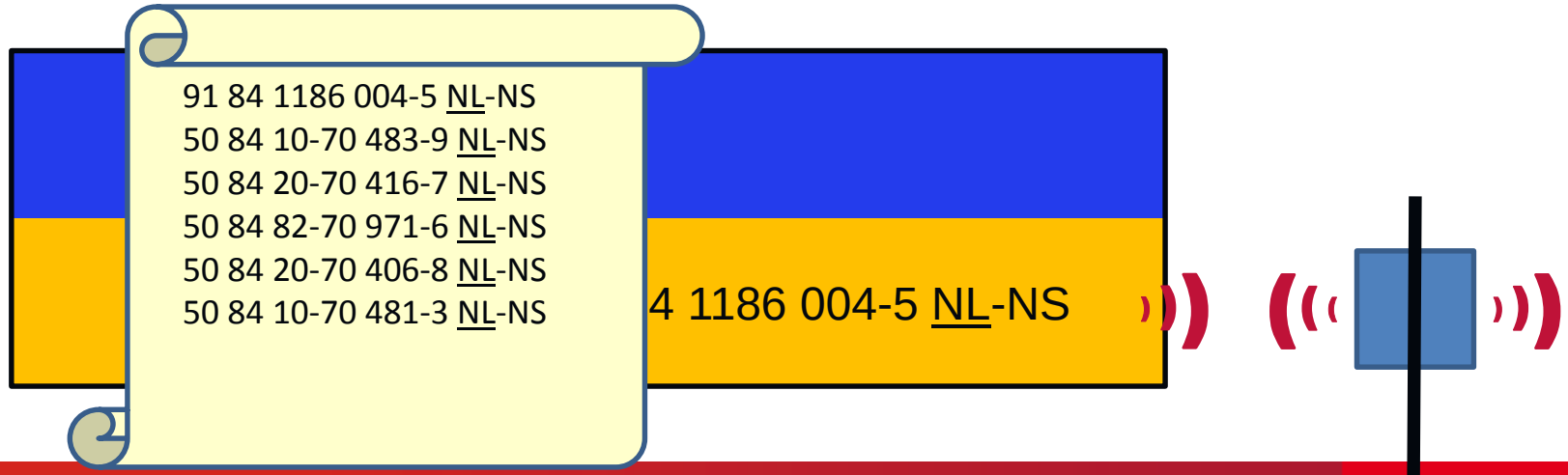
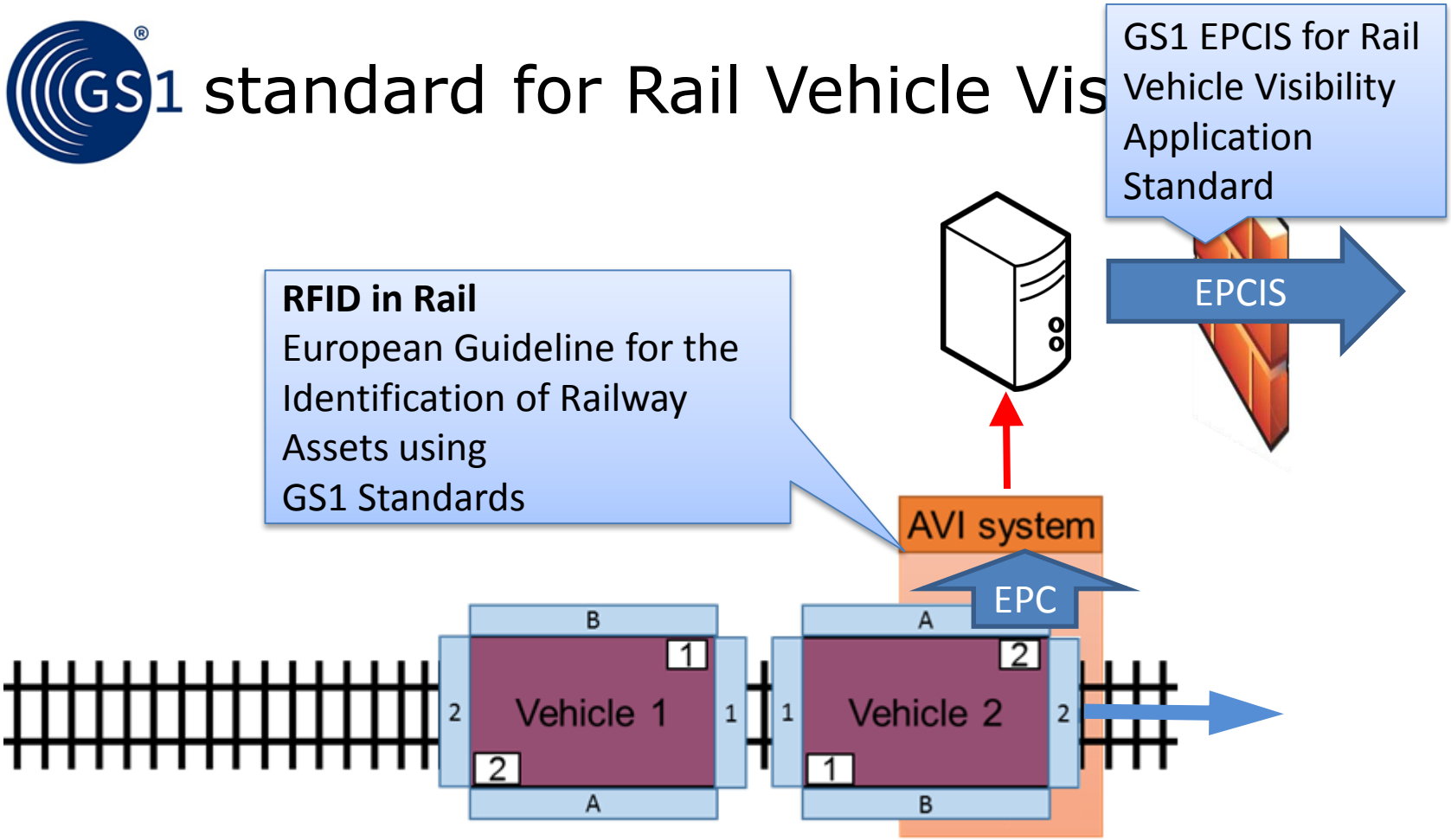
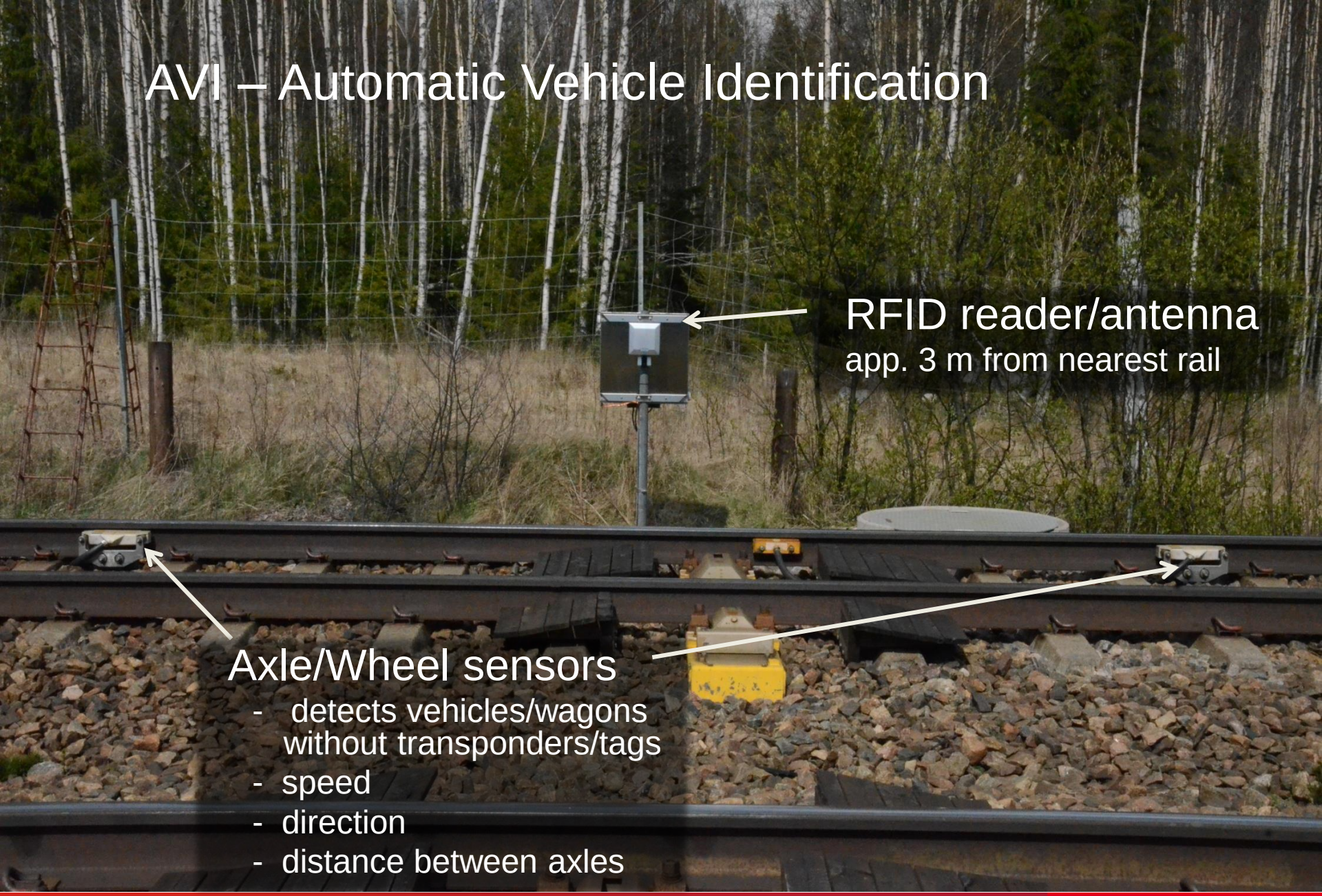


GS1 standard for Rail Vehicle Vis

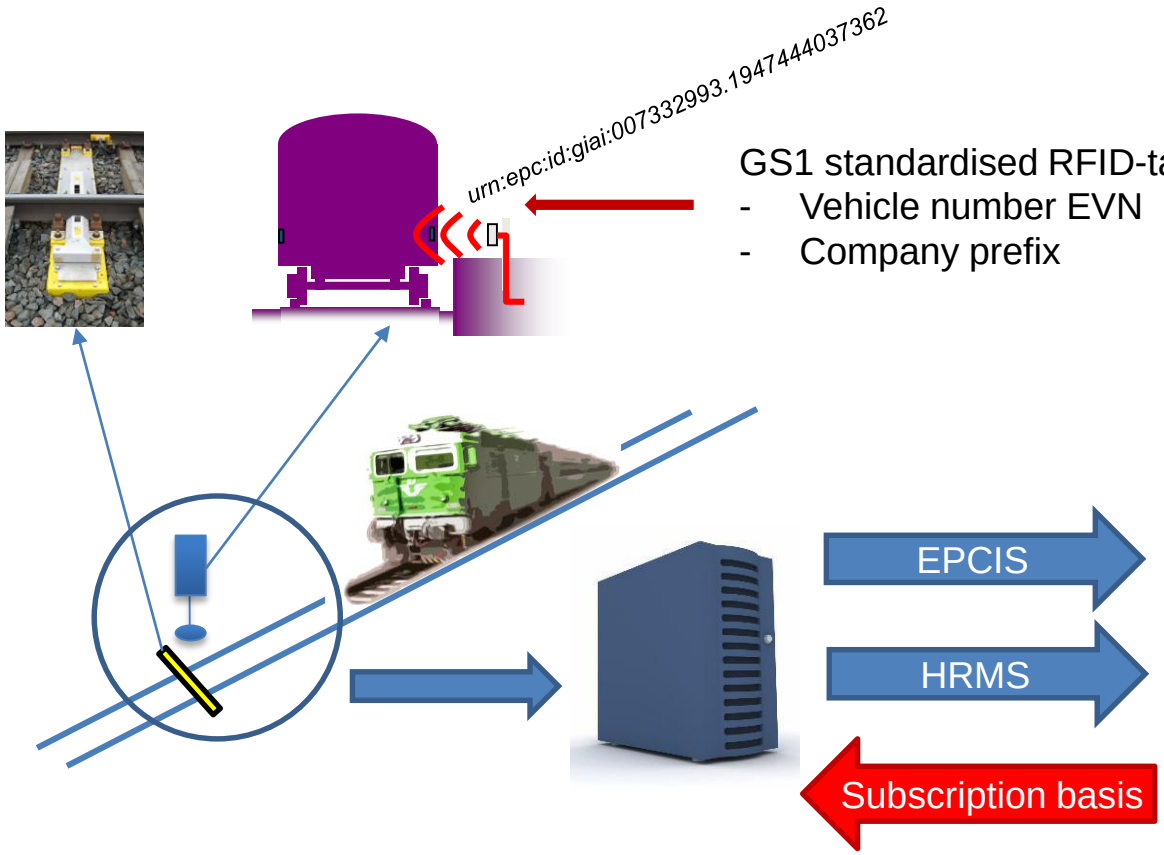


Global agreement, applied across Europe

AVI – Automatic Vehicle Identification



Identification and positioning of rail vehicles



GS1 standardised RFID-tag on vehicle (~ 4 €/pcs)

- Vehicle number EVN
- Company prefix

- Vehicle ID, Location, Time, Direction
- Hotbox, Hot wheel, Wheel damage
- To Whom, What, How

Requirements for coding the tags

- Air protocol according to EPC Gen 2 ISO 18000-63
- Data contents must meet the requirements of EPC GIAI-96
- EPC Tag Data Standard, v.1.9, November 2014, by GS1

Position	Length	Description	Value
1-8	8	Header	00110100 (fixed)
9-11	3	Filter value	000 (fixed)
12-14	3	Partition	101 (5, 7-digit ownership mark)
15-38	24	Company prefix	7-digit
39-96	58	Individual Asset Reference	17-digit (see below)

Position	Contents	Coding
1	Side indicator	0 = not in use 1 = not in use 2 = A-end (e.g. hand brake end) 3 = B-end (e.g. non-hand-brake end) 4-9 = engaged
2-5	engaged	To be filled with zeros
6-17	EVN	12-digit vehicle number

Managing the four W's

Monitoring process

+

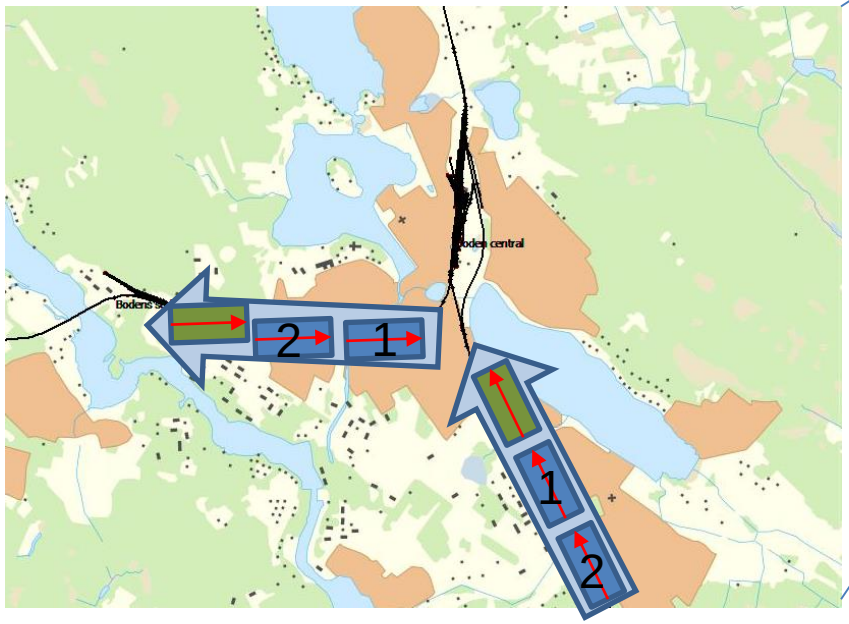
RFID reading

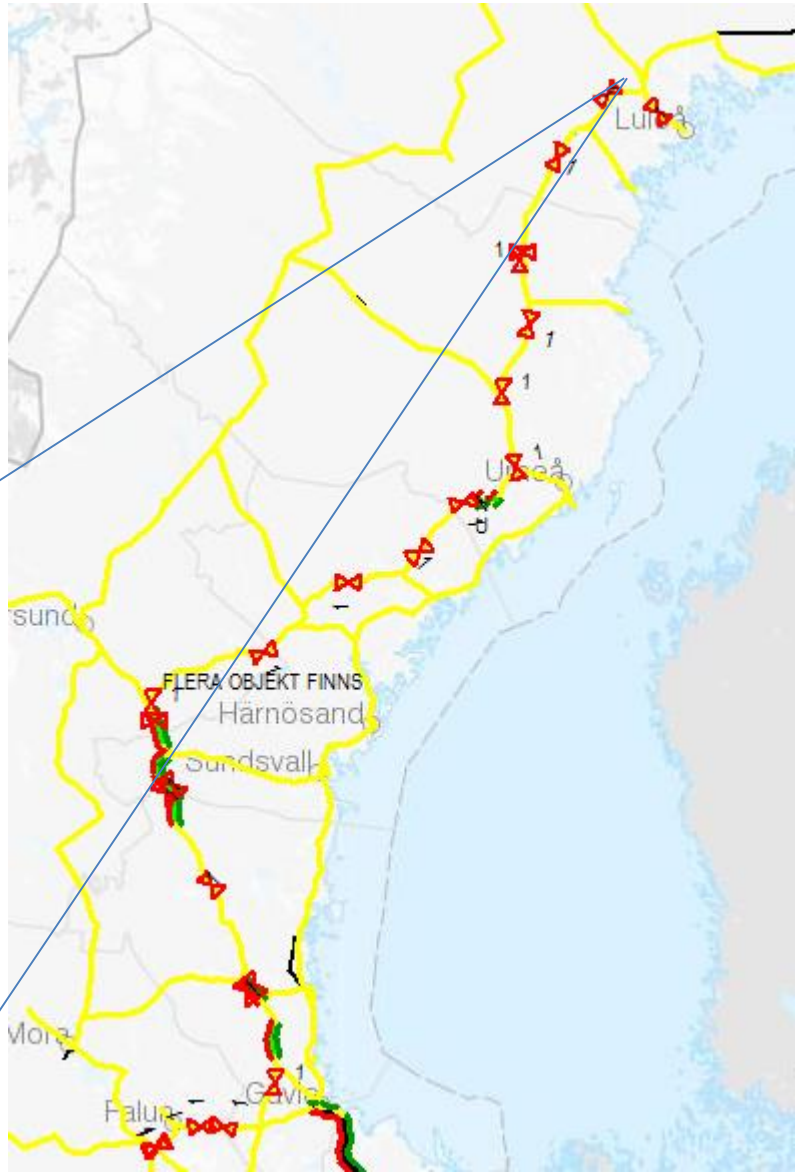
→

condition report

Steel train Luleå-Borlänge

Train composition changes during the journey



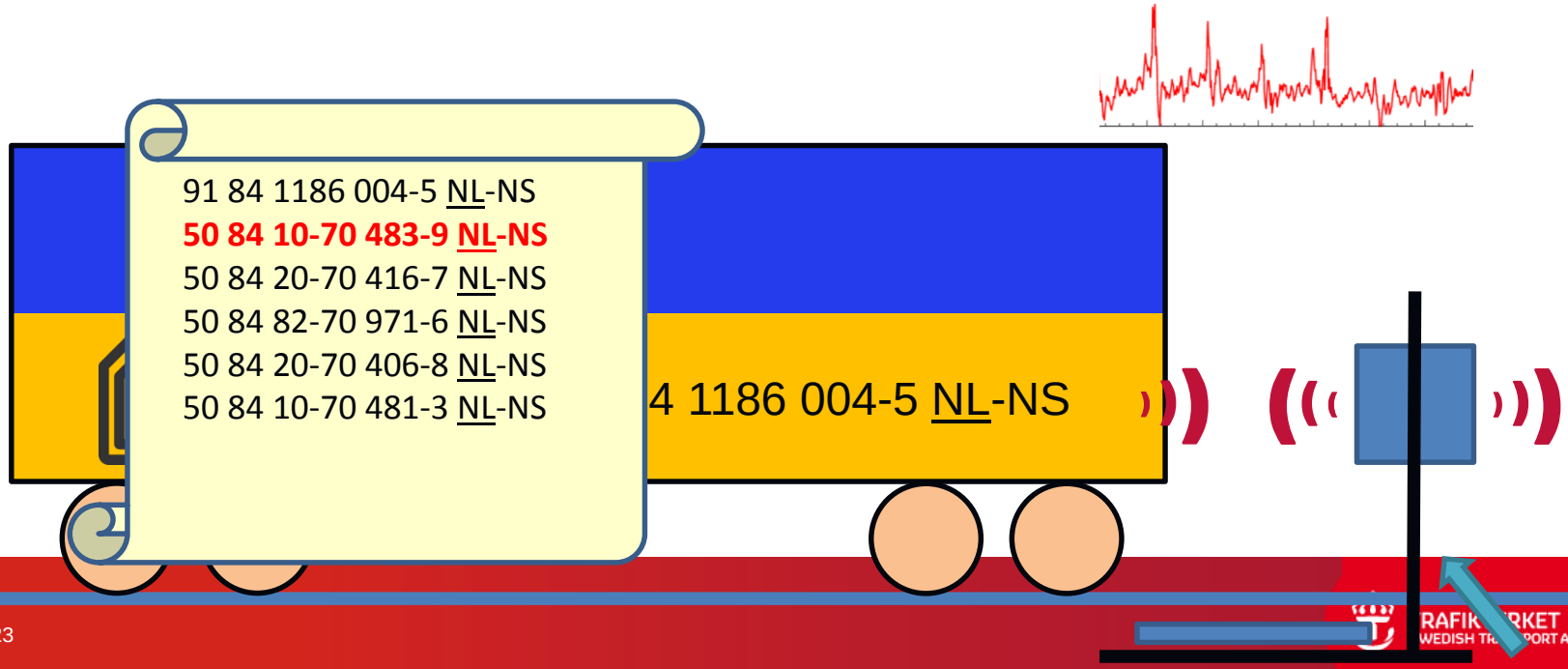


How does Vehicle Identification help Rail? Dutch example

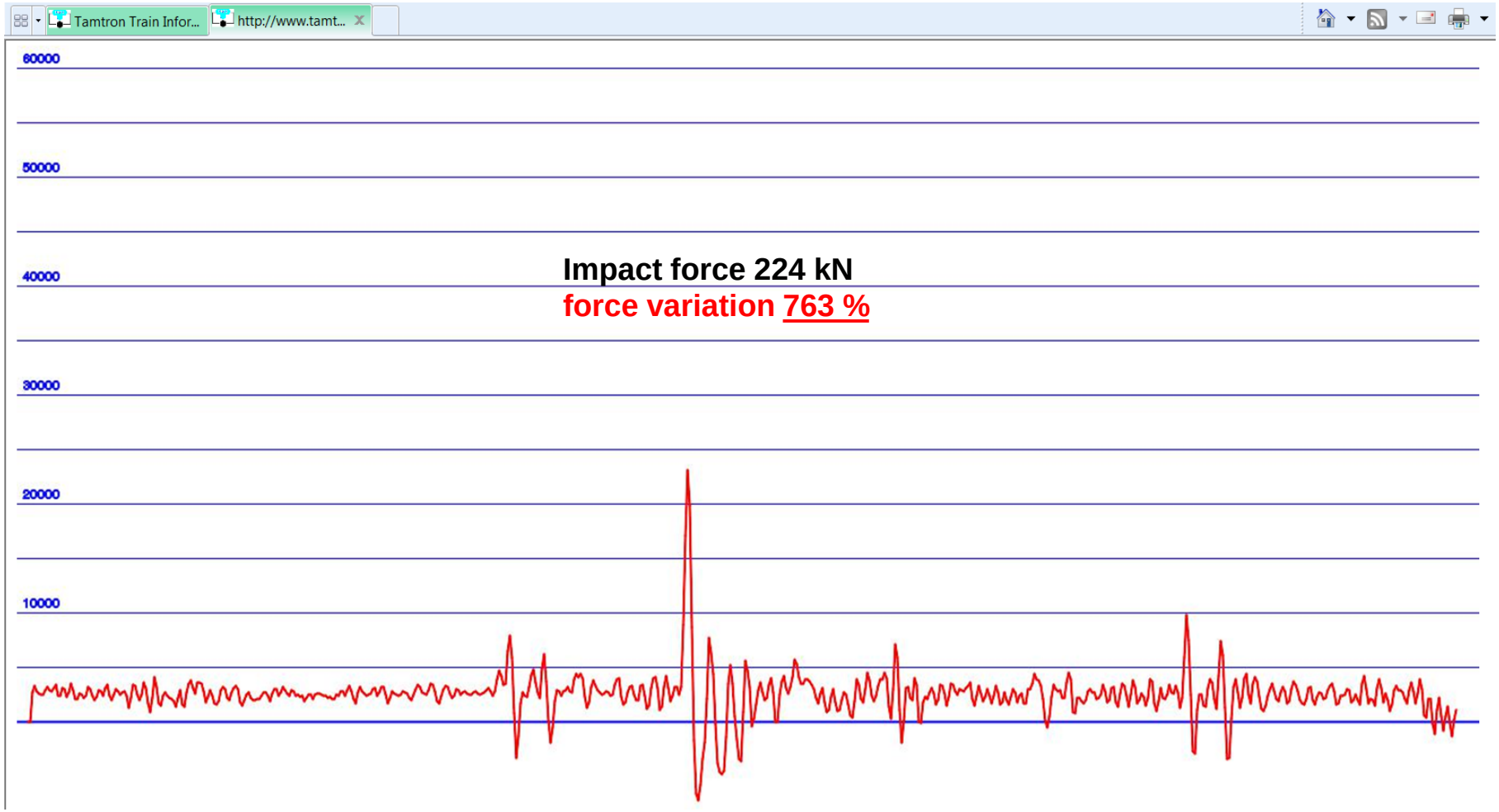
- Fall 2002: Square wheels (caused by falling leaves)…
- Flat surfaces on wheels causing damage on bearings with risk of derailment
- Monitoring wheels with Gotcha/Quo Vadis, immediate repair using kuilwielenbank

How does Vehicle Identification help Rail? Dutch example

- Result: drastic reduction of damage to both wheels and tracks
- In turn costs and risks are also significantly reduced



An example: Wheel Impact Load Monitoring



Results vs. limits:

Alarm	Level	Limit	Actions
Dynamic impact force Q_{imp}	Q5	> 500 kN	To be removed from the train ASAP; speed limit of 50 km/h until removal
	Q4	> 450 kN	Speed limit of 50 km/h after alarm; wheelset shall be fixed before the next loading
	Q3	> 350 kN	No speed limit, wheelset shall be fixed before the next loading
	Q2	> 300 kN	Wheelset shall be fixed during the next service
	Q1	> 250 kN	ECM schedules the corrective actions
Dynamic factor f_{dyn}	f3	> 800 %	Wheelset shall be fixed before the next loading
	f2	**> 600 %**	**Wheelset shall be fixed during the next service**
	f1	> 400 %	ECM schedules the corrective actions

A wagon needs maintenance:

Tamtron Train Information System

Log out | Main menu | Check point | Update | Print | Export

Check point: Lautiosaari = where

Train: 03.09.2013 01:35:58 = when

Total weight:	627.361
Speed:	86 km/h
Direction:	TO NORTH
Train type:	CARGO
Locomotives:	1
Wagons:	25
Air temperature:	8
Track temperature:	11

WNR = Wagon number
FF = Wheel faults in wheels
FV = Force variaton %
EFL = Estimated flat length
WTYPE = Wagon type
IF = Impact force kN
FT = Fault type

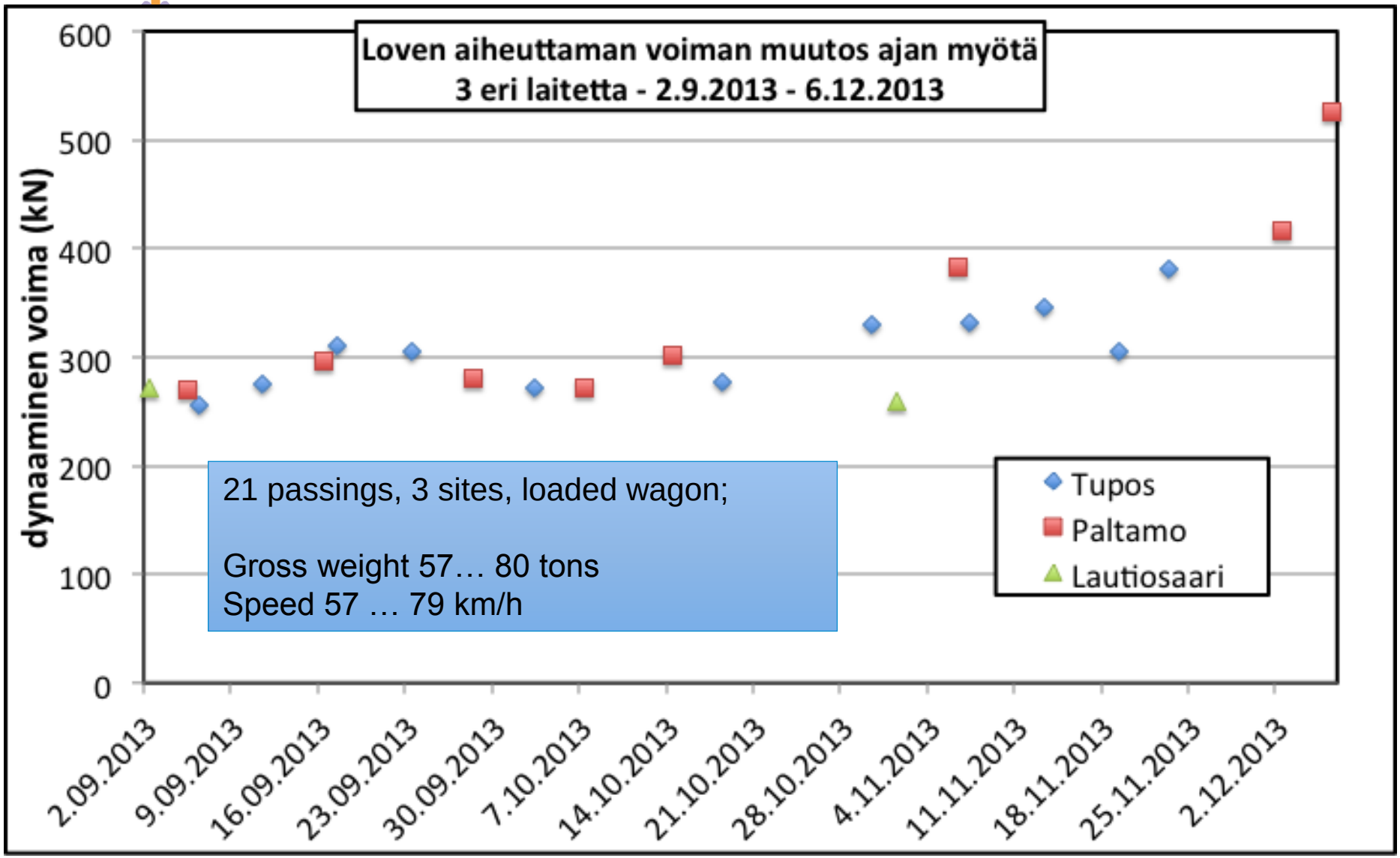
Answers to the four W's!

= why

Wheel fault alerts: (In alert order) Wagon order

					Left rail					Right rail				
Critical														
WNR	Wagon id	WTYPE	Wagon weight	Axle weight	FF	FV	EFL	IF	FT	FF	FV	EFL	IF	FT
Warning														
WNR	Wagon id	WTYPE	Wagon weight	Axle weight	FF	FV	EFL	IF	FT	FF	FV	EFL	IF	FT
W2	821047194930 = what	OC, OCE, OCC, OCC-Y, OCPP, OHN, OHR, SG, SG-T, SGN	22.440	1 - 5.703 2 - 5.837 3 - 5.466 4 - 5.433	5	763	109	224	FLAT					

A long-term follow-up of one wheel



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DPC analysklient

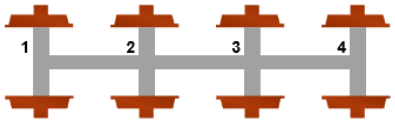
TRAFIKVERKET DPC analysklient

Dölja filter raden

Dölja axel

Vagn id: 5688 2364

None | Alla vänstra axlar | Välj alla axlar | Alla högra axlar



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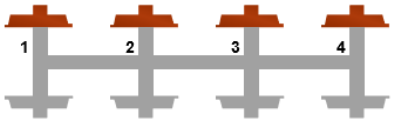
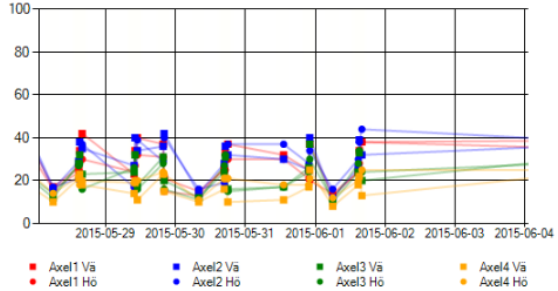


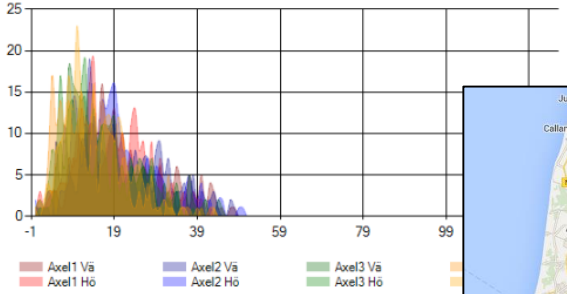
Lägg till vagn

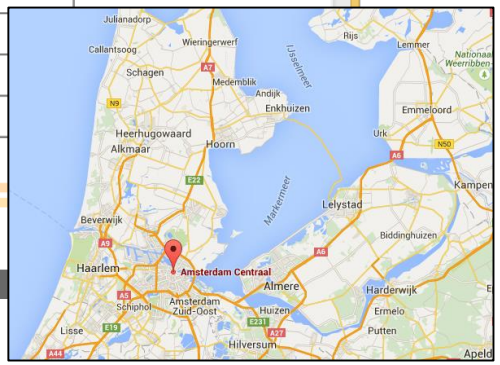
Hur mår axeln | Axelns tempraturutveckling | Lorem ipsum

Varmgång ex.1

Varmgång | Tjuvbroms







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Varmgång ex.2

Advantages of combining RFID with the data

RFID in use

RFID-Reading = ID

Day 1, alarm:
- time
- site
- cause
- direction
- # of axle

Day 2, alarm:
- time
- site
- cause
- direction
- # of axle

Day n, alarm:
- time
- site
- cause
- direction
- # of axle

VALTSU system

→ wagon 12345678901-2 + results for a wheel

- ID + data = information
- Unique history
- Even unique alarm limits
- Less repeated alarms
- Simple tracking
- No misspelling

Train Dispatcher

"Faulty wagon 12345678901-2"

Train Driver

Check

Technical Control Room

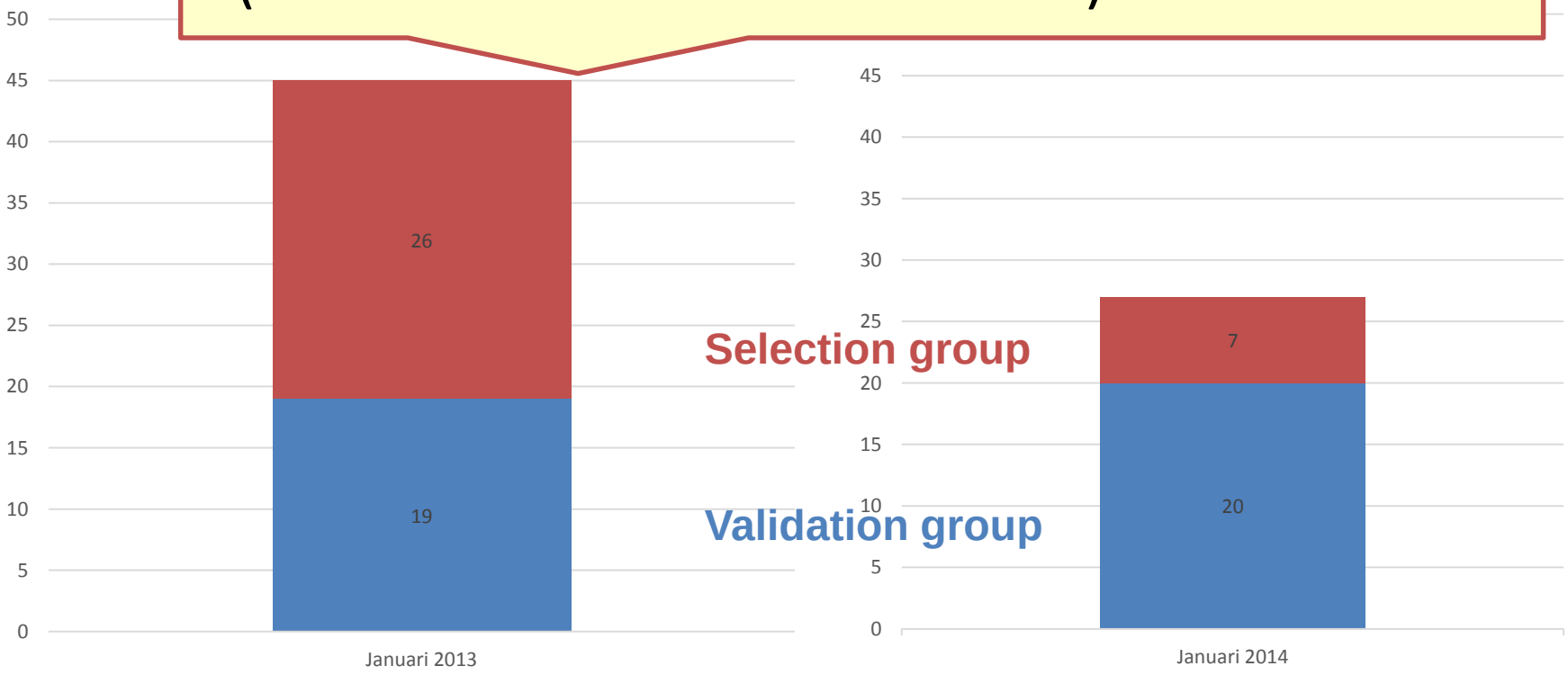
Maintenance

Train Traffic Control

RU's operative services

Manual monitoring of wheel-damages

Saves about 2 million euro/year in real process just avoiding delays
(less maintenance not included)



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Service introduced 2017:

Identification and positioning of rail vehicle

2017
- Maintenance based upon WTMS
- Less traffic disturbance
- Track and Trace
- Correct train composition
- Efficient logistics

2018
- Automatic reporting
- Satellite positioning
- Introducing Business location
- Etc…

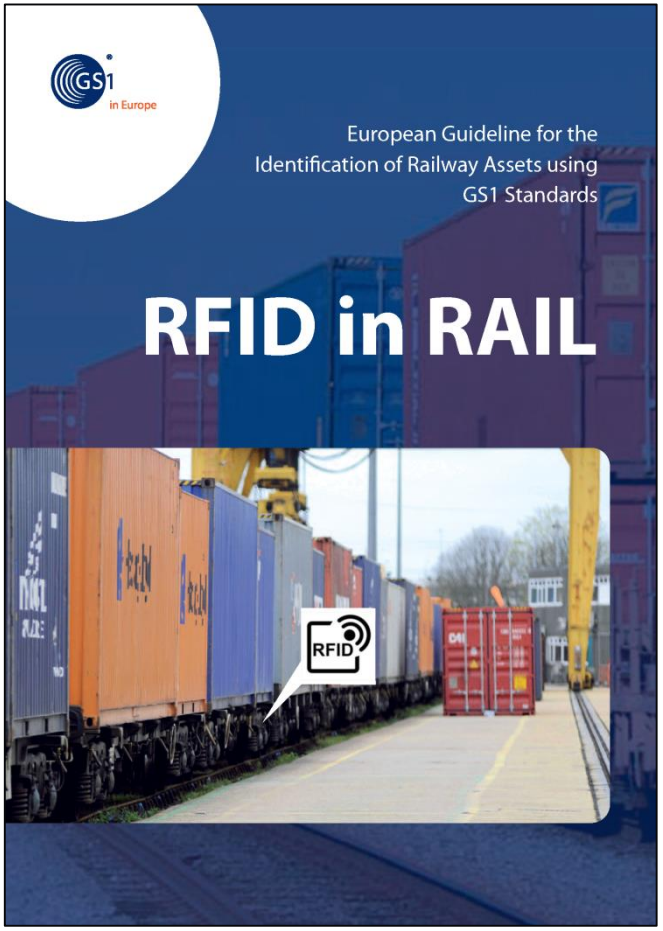
Standardisation wanted…

- **EIM (European Rail Infrastructure Managers)** support including/transferring the **GS1 guideline** in a new standard
  - Cooperation between EIM, CEN/CENELEC and GS1

- **CURRENT:**

  Finland has sent out a **<u>work item request</u>** for a new EN standard through Finnish Standards Association SFS at the end of September

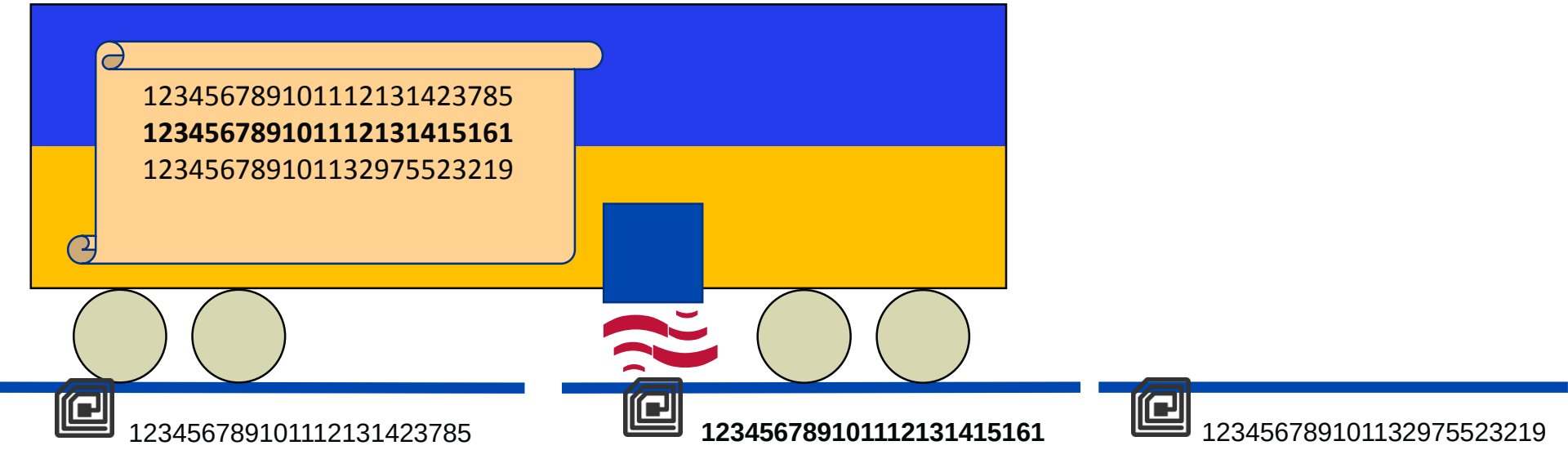
  → evaluation and voting arranged by EN TC225/WG4



Other uses for RFID in Rail?

The concept also works ‘upside down’

- ‘The same world – but in reverse:
  - Instead of Trains passing readers
  - Readers pass along the track (capturing ID’s from RFID tags).

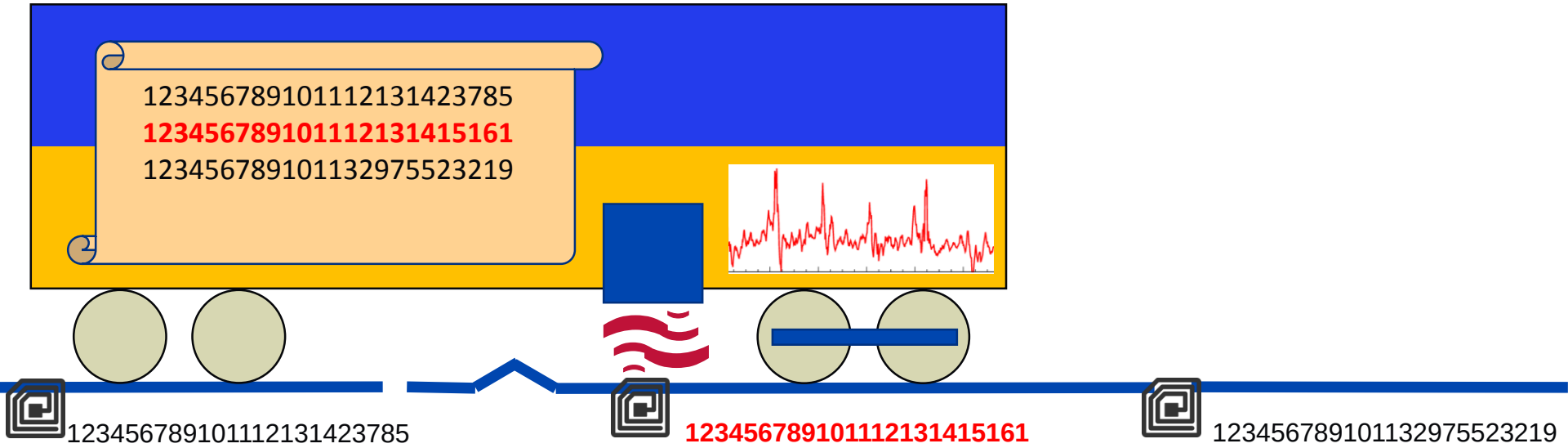


Other uses for RFID in Rail?

They enable capturing and processing massive datasets.

- Action = Reaction: bad tracks cause damage to wheels
- Finding small defects before they become serious **using detectors in normal trains** with same result as before: reduction of cost and risk
- **Feasible only through automated** capture and processing of data

Other uses for RFID in Rail?



Thank you!

Questions?