

# 13<sup>th</sup> UIC Sustainability Conference



Digital communication in railways

Framework

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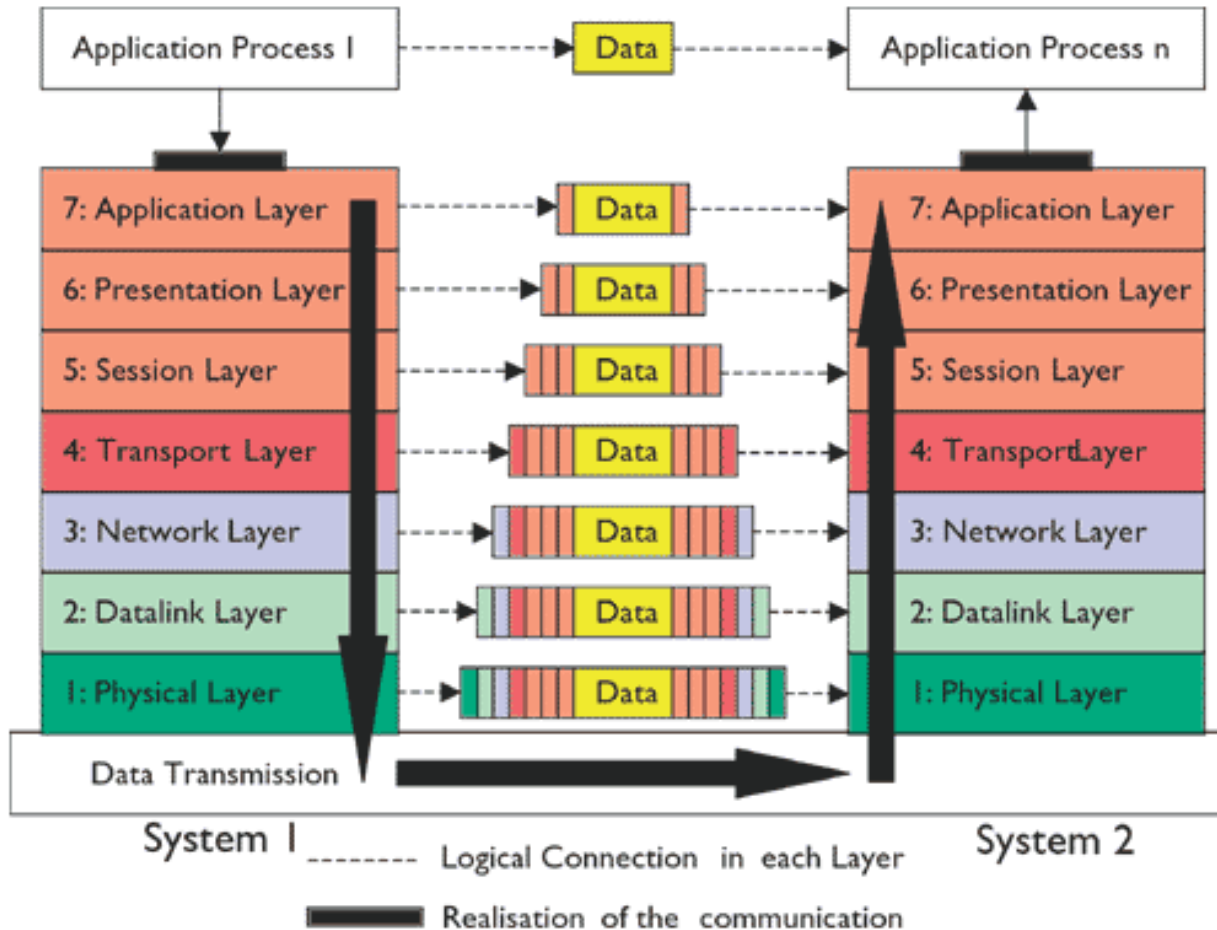
12, 13, 14 October 2016

# Digital communication

- Bringing ethernet on the train
- Energy metering and billing
- Eco-driving



# Ethernet on the train



End user layer

Syntax layer: e.g. encryption

Creating & terminating of sessions

TCP: e.g. message traffic control

Packets: the letter with IP-address

Frames: the envelopes

Cables, hubs, ...

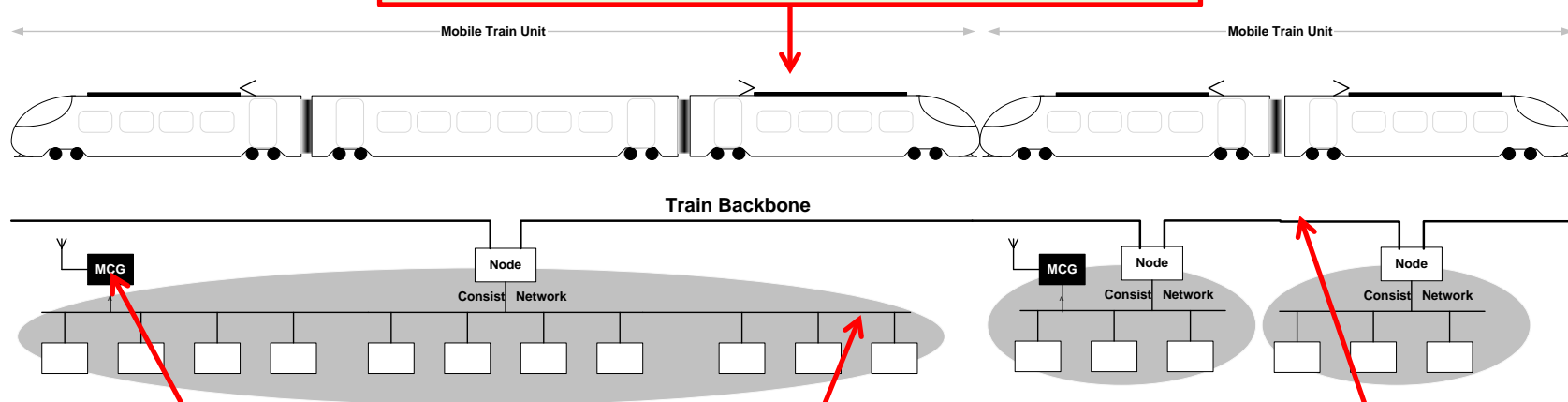
Communication layers for ethernet  
are defined in IEC 61375-series



# Ethernet on the train



TCN General architecture  
*IEC 61375-1: General Architecture*  
*Four on-board communication technologies considered:*  
*Train level: Wire Train Bus, Ethernet,*  
*Consist level: Ethernet, Multifunction Vehicle Bus, CANopen*

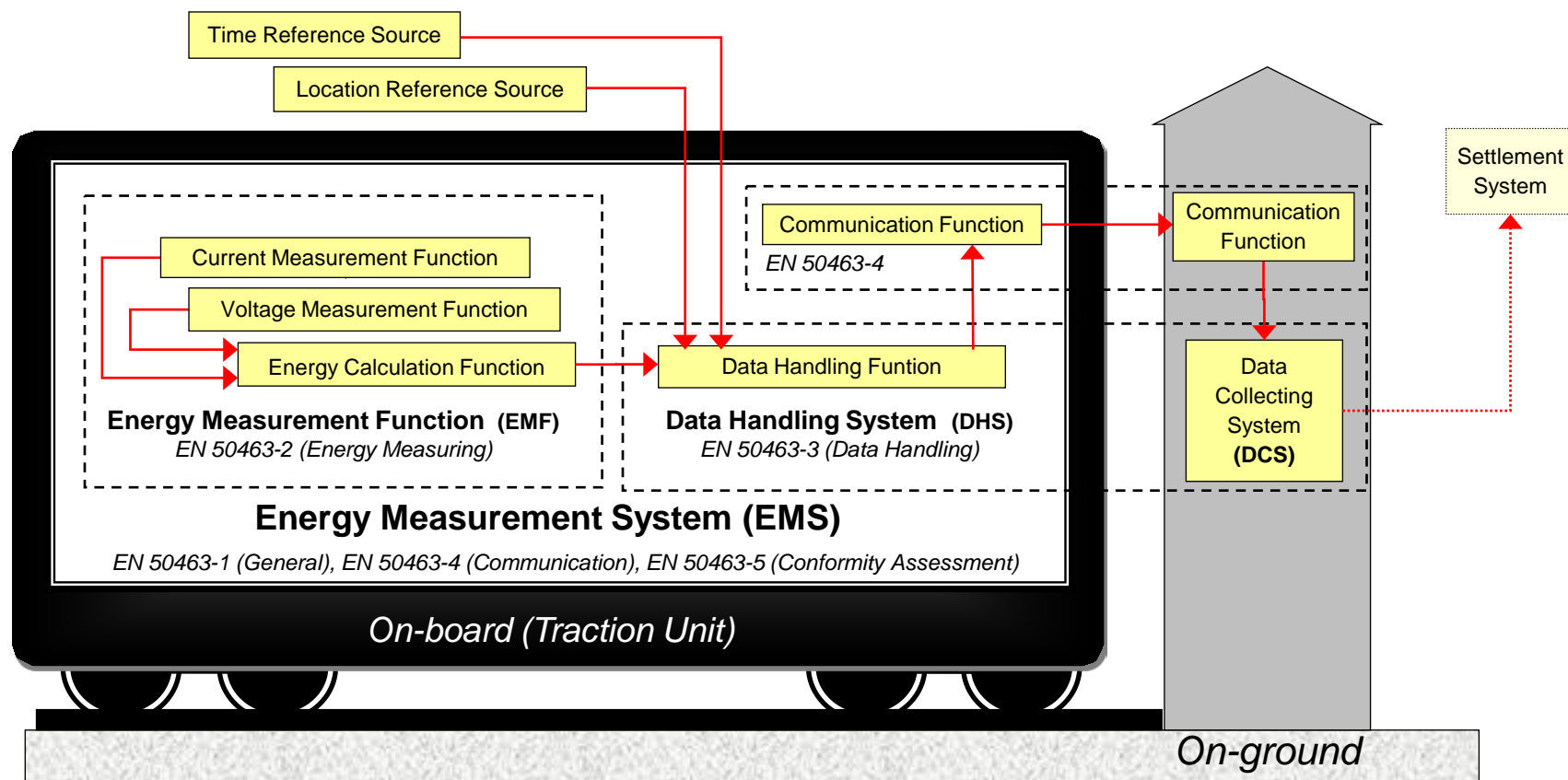


TCN On-board to Ground communication  
*IEC 61375-2-6:*  
*Mobile Communication Gateway*  
*Bearer: all existing technologies*  
*standardised by ETSI and ITU*  
*Security: authentication, authorisation,*  
*accounting*

TCN - Consist Network  
*IEC 61375-3-3:*  
*CANopen*  
*IEC 61375-3-4:*  
*Ethernet Train Backbone*  
*Essential requirements and basic*  
*parameters*  
*End device interface specification*

TCN - Train Backbone  
*IEC 61375-2-5:*  
*Ethernet Train Backbone*  
*IEC 61375-2-3:*  
*Communication Profile*  
*IEC TR 61375-2-7:*  
*Wireless Train Backbone (WLTB)*  
*IEC TS 61375-2-4:*  
*Application profile*

# Metering and billing

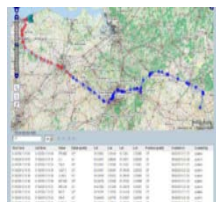


# Metering and billing



Energy meter is mandatory\* on all new, renewed and upgraded rolling stock (Commission Regulation 1302/2014).

\* mandatory if rolling stock is intended to be used on networks equipped with DCS

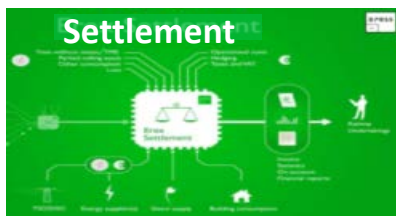


Communication to ground will be required via new version of LOC&PAS TSI, referring to new version of EN 50463- series.

2017

Each member state shall be able to collect the measuring data on ground (Commission Regulation 1301/2014).

2019



Each member state shall be able to exchange this data, validate the energy consumptions and to allocate them to the correct end user (Commission Regulation 1301/2014).

2019





# Metering and billing



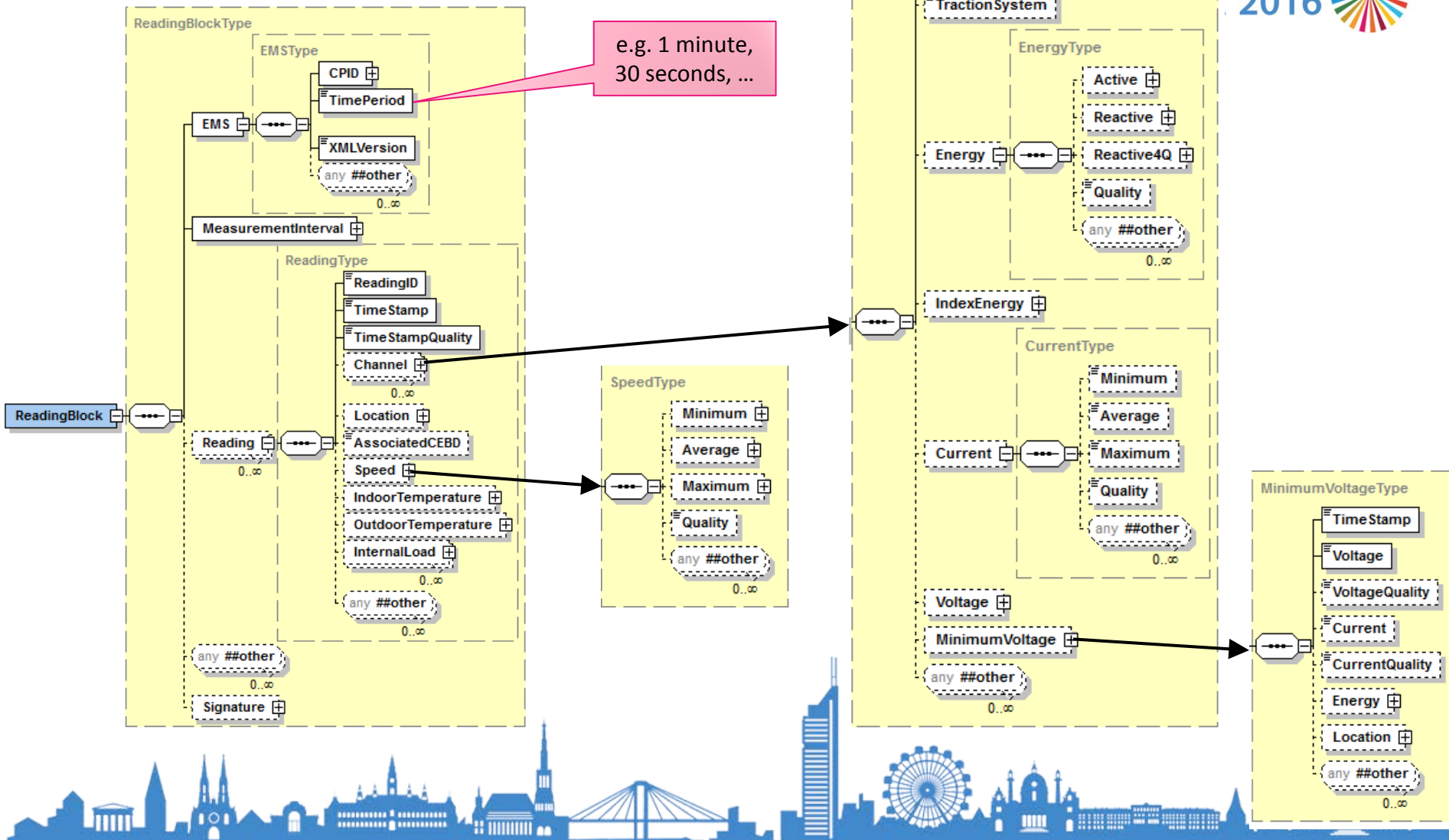
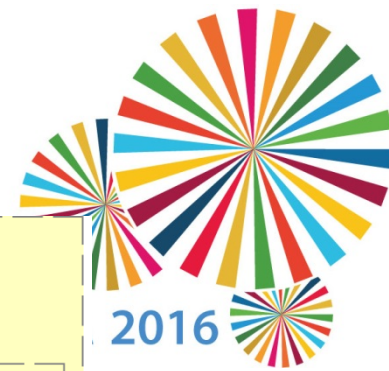
Communication from EMS on-board to DCS on ground:

- Based on XML
- Supports exchange of following data
- Permits to use simple request/reply or automatic sending
- HTTP or FTP with mailbox
- Different communication protocols, e.g. Wi-Fi and 4G
- Possible to use IEC 61375 for communication layers  
(or a dedicated wireless connection if a communication architecture based on IEC 61375-2-6 is not available)

Application data type	Description
CEBDBlock.xsd	Data for billing (5 minutes period )
EventSet.xsd	EMS Events
ReadingBlock.xsd	Data for energy management ( <b>see next slide</b> )
CommunicationConfig.xsd	EMS communication configuration
ChangeCommunicationConfig.xsd	Command for change communication configuration
AssetData.xsd	EMS asset configuration
State.xsd	EMS real time measurements



# Metering and billing



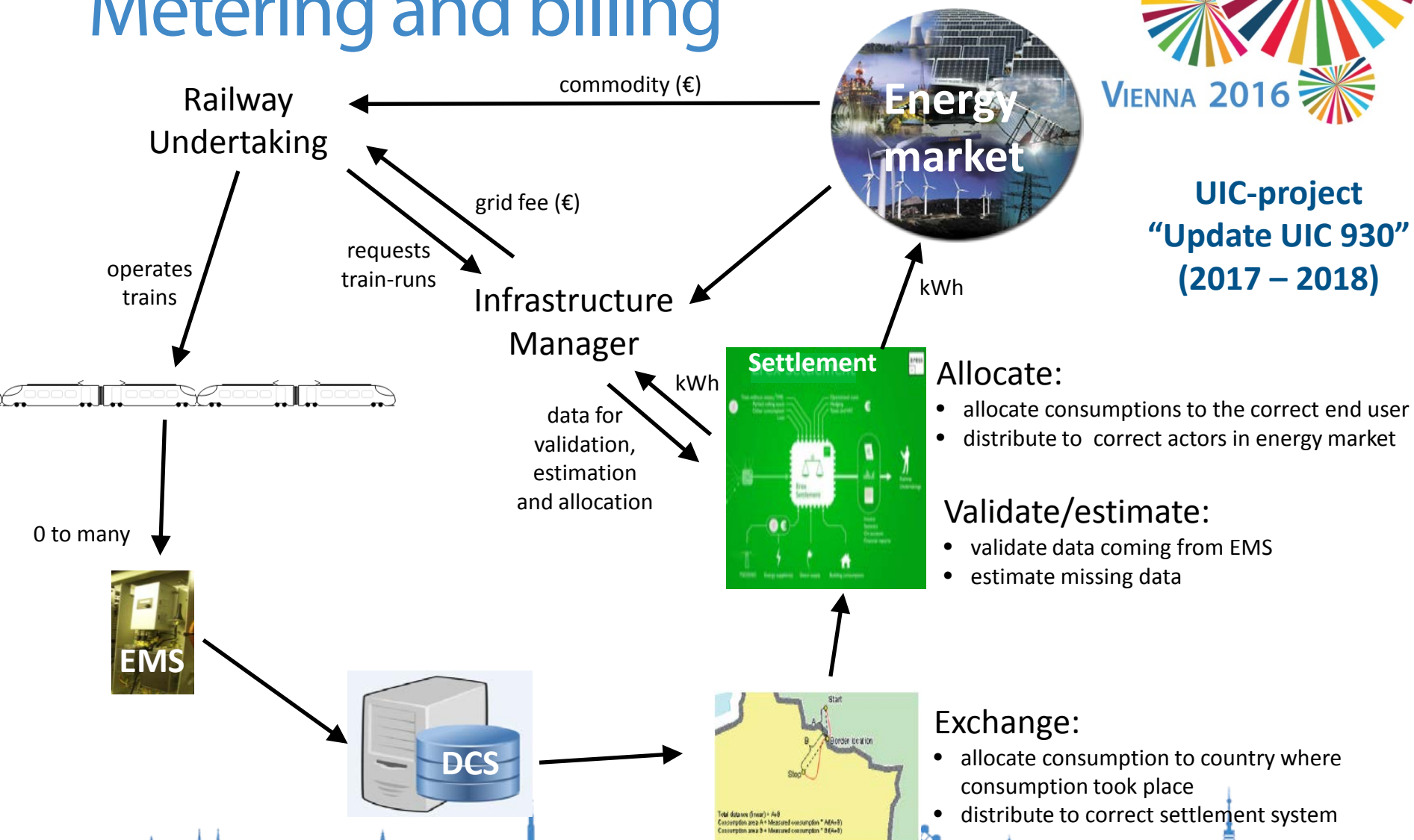


# Metering and billing



VIENNA 2016

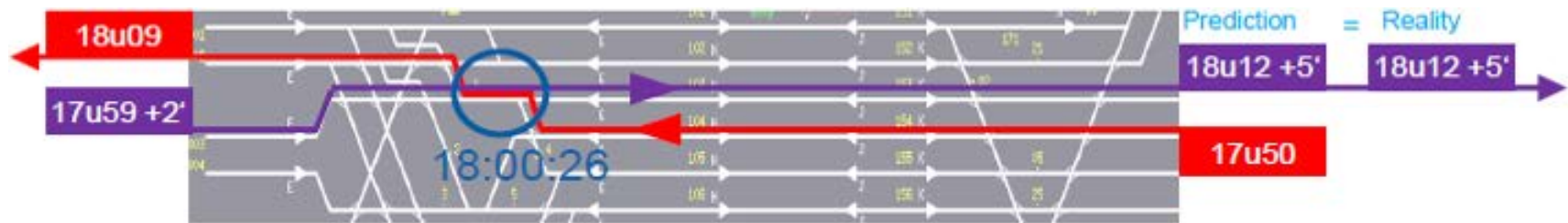
**UIC-project  
“Update UIC 930”  
(2017 – 2018)**



# Eco driving



New Traffic Management Systems are able to detect conflicts in advance.  
The dispatcher can propose a new solution. This will be analysed immediately.



The new passing times on critical parts of the network (e.g. passing before hh:mm:ss at maximal x km/h) should be transferred to tools on trains like Driving Advisory Systems (DAS) or Automatic Train Operations (ATO).



# Eco driving



By giving feedback to Driving Advisory Systems (DAS), they will become more intelligent and unplanned stops can be avoided. This will help the Railway Undertakings to cut 20% of energy costs.



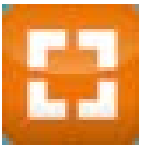
Less energy consumption is also good for the environment.



Thanks to a DAS connected to TMS, conflicts can be avoided and trains will run more on-time. After the introduction of DAS in Denmark punctuality increased from 91% to 94%.



A better spread of the train-runs helps to reach a better utilisation of the infrastructure. The ATO on Crossrail (London) will permit 24 trains by hour.



A train driver will be informed in advance of a red signal and receives advices on how to avoid this red signal. This will increase indirectly safety of train traffic.



# Eco driving



- e-drivers is a team of motivated train drivers of SNCB Logistics
- February 2015: start competition “Transport 2600 ton as energy efficient as possible”
- Already in May 25% energy reduced!
- By avoiding 72% of restrictive signs (double yellow or red) => increasing safety
- By doubling the amount of regenerated energy (while braking)
- Best result on Monceau-Aachen: 7,11 Wh/tkm (trains without meter invoiced at 16 Wh/tkm)
- Similar results reached on other trajectories => start expanding test to all train-runs



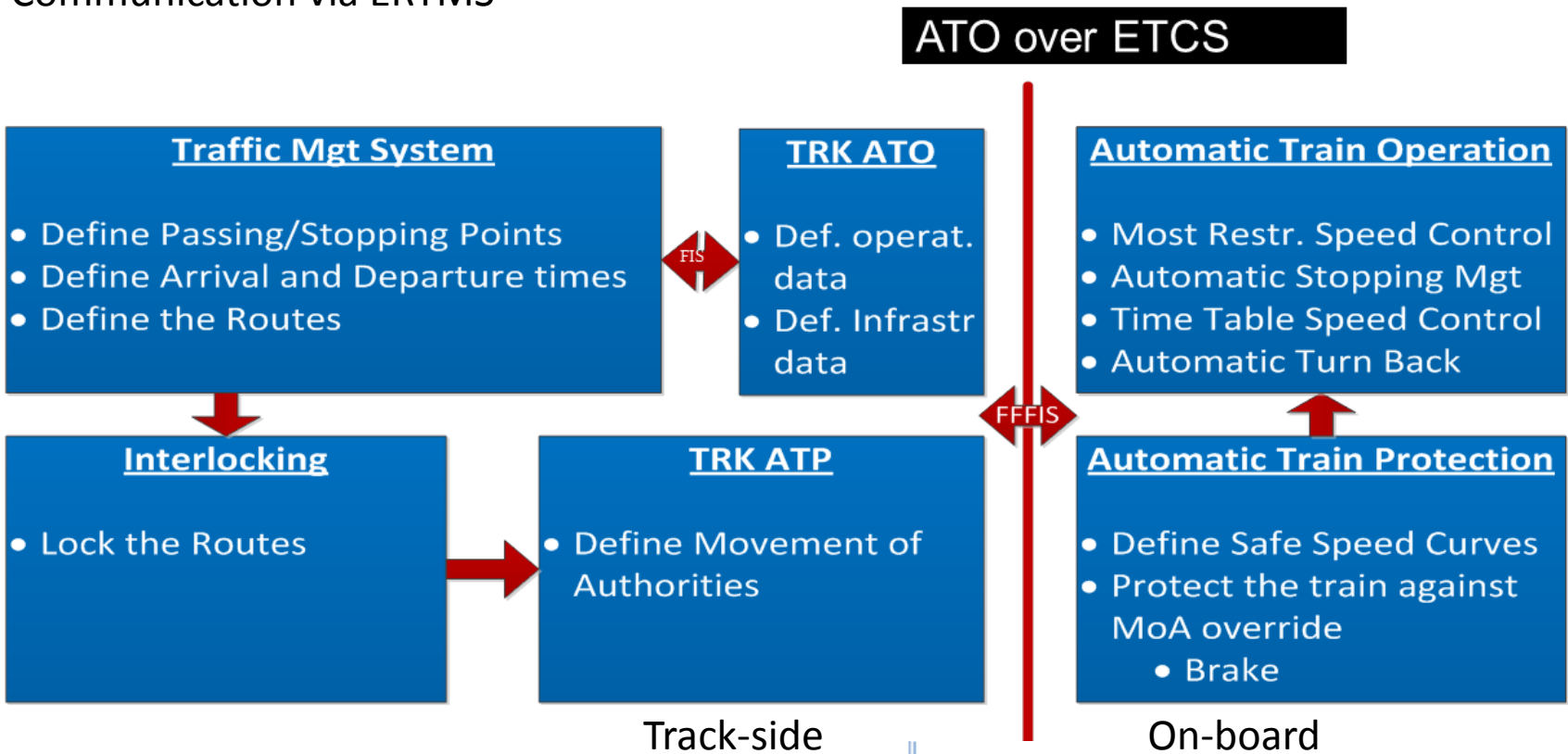


# Eco driving

A request is made to also  
include DAS over ETCS



Communication via ERTMS



(based on a presentation of Benoit Benfait, UNISIG)

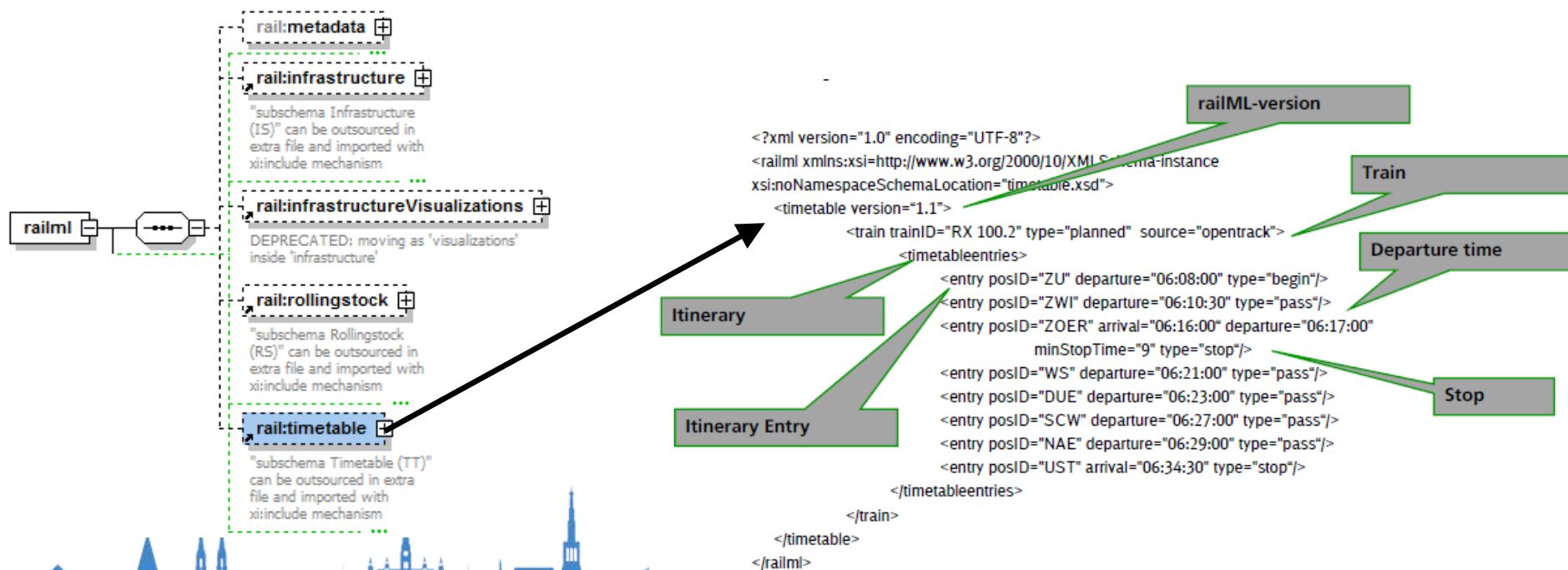


# Eco driving



Communication outside scope of ERTMS:

- Data layer can be based on RailML: [www.railML.org](http://www.railML.org)
- Message layer and protocol layer as defined in EN 50463-4
- Communication profile based on IEC 61375 (or dedicated wireless connection)
- To be further specified in UIC-project SFERA (2017 - 2019)





# ICT on TRAINS



- CENELEC organises every two years a two day-workshop.
- The first three editions were in Prague, Milan and Birmingham.
- The fourth conference will take place in Belgium in the autumn of 2017.
- Every CENELEC-expert can still request to join WG 15-4 and help us preparing the program for this workshop.
- The workshop has a focus on regulation, standardisation, research and good practices.
- The workshop is open to everyone interested in this topic: Railway Undertakings, Infrastructure Managers, railway industry, associations, universities, ...
- More information: <http://www.ict-on-trains.org/>

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