

X2Rail-1 ATO over ETCS (up to GoA4)

Valenciennes, 15th November 2017



What is ATO over ETCS ?



Performances

- Suppression of reaction time due to the driver (from ETCS safety curves)
- Reduced dispersion in the travel times
- Reduced margins included in Theoretical Time Tables
- Reduced operational headway
- More trains per hours on the same infrastructure

Quality of Service

- Better punctuality
- Greater comfort impression

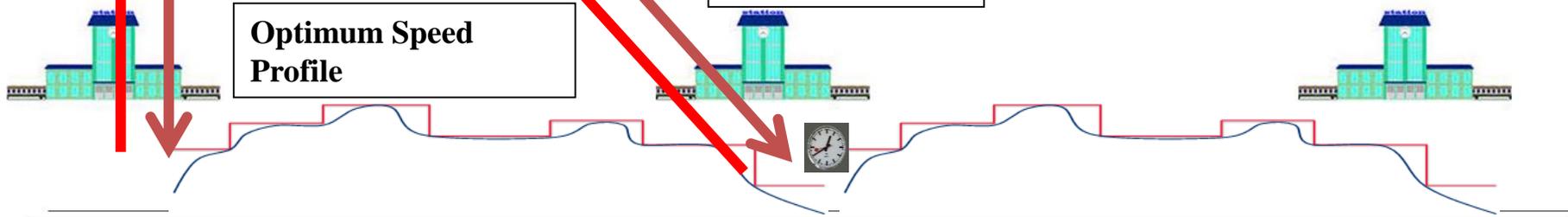
Operation Costs

- Reduced energy consumption
- Reduced train fleet and staff to operate a line for a given operational headway

**Time Tables and
Infrastructure data**

**Optimum Speed
Profile**

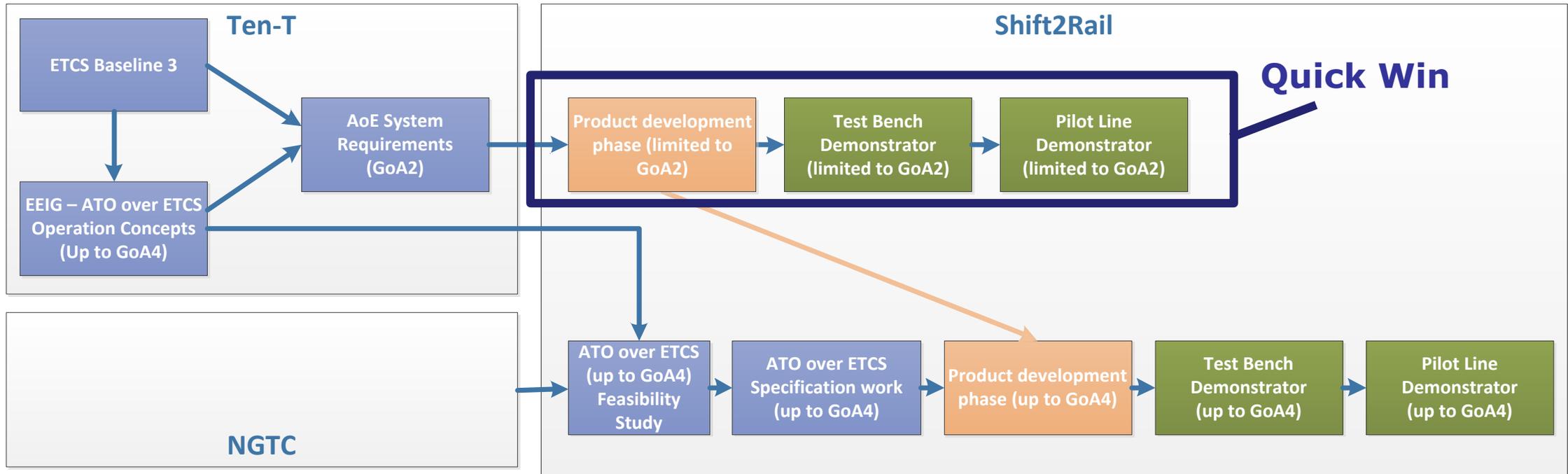
**Guaranteed
arrival and
departure time**



Grade of Automation	Train Operation	Setting train in motion	Driving and stopping train	Door closure	Operation in event of disruption
GoA 1	ATP with Driver	Driver	Driver	Driver	Driver
GoA 2	ATP and ATO with Driver	Driver / Automatic	Automatic	Driver	Driver
GoA 3	Driverless (DTO)	Automatic	Automatic	Attendant / Automatic	Attendant
GoA 4	Unattended (UTO)	Automatic	Automatic	Automatic	Automatic

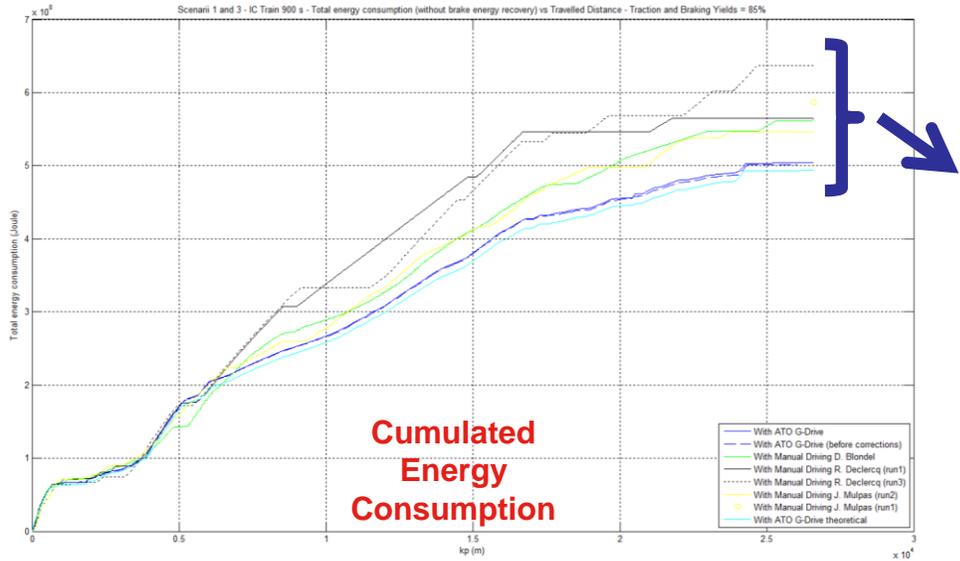
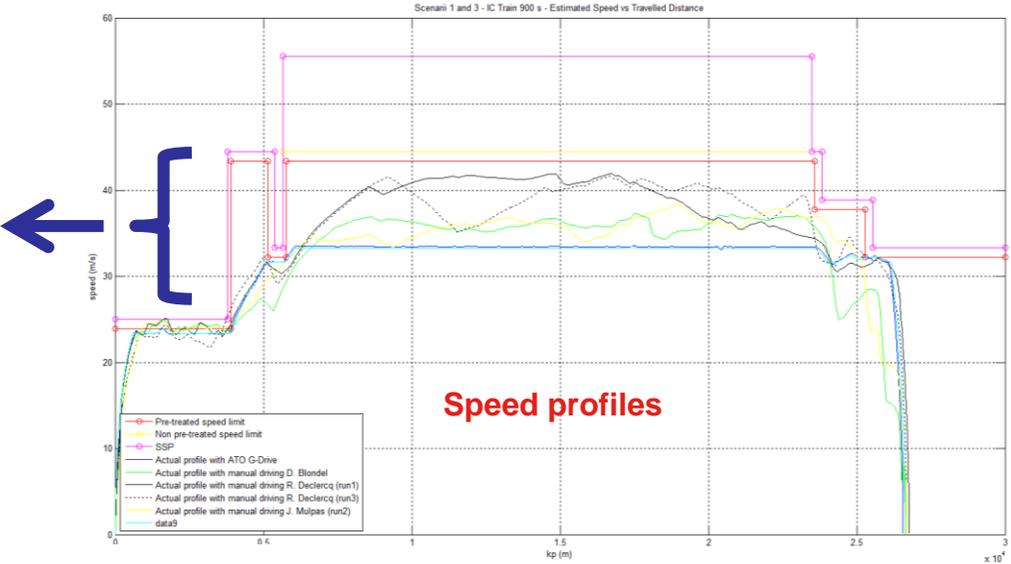
GoA1+
C-DAS over
ETCS

ATP: Automatic Train Protection
 ATO: Automatic Train Operation
 DTO: Driverless Train Operation
 UTO: Unattended Train Operation



Example of Energy Savings in GoA2 Intercity trains

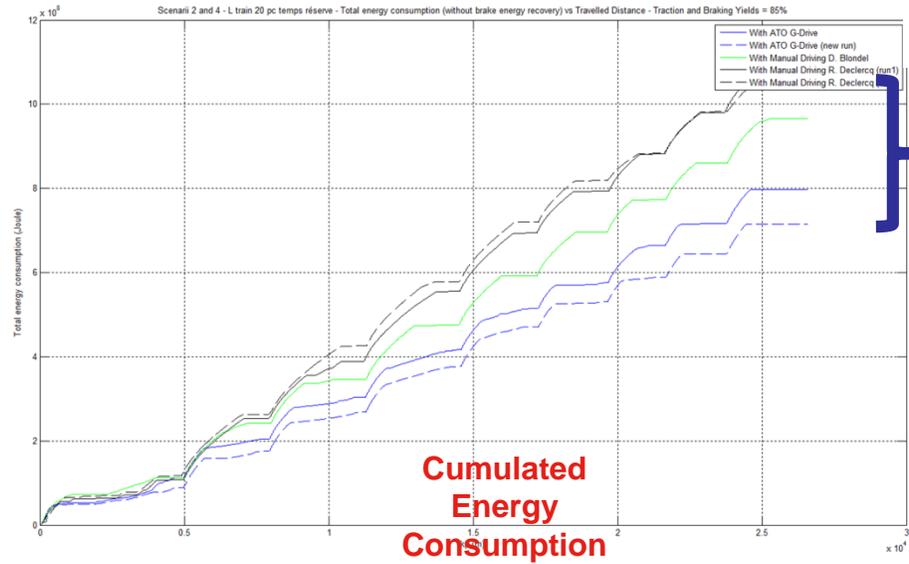
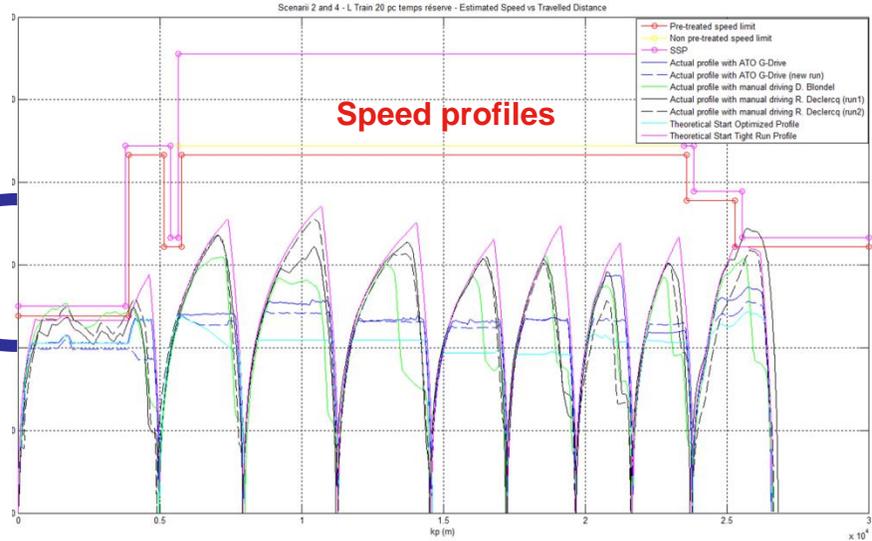
Different driver behaviours on same journey...



... lead to potential consumption of up to **15%**

Example of Energy Savings in GoA2 Local trains

Different driver behaviours on same journey...

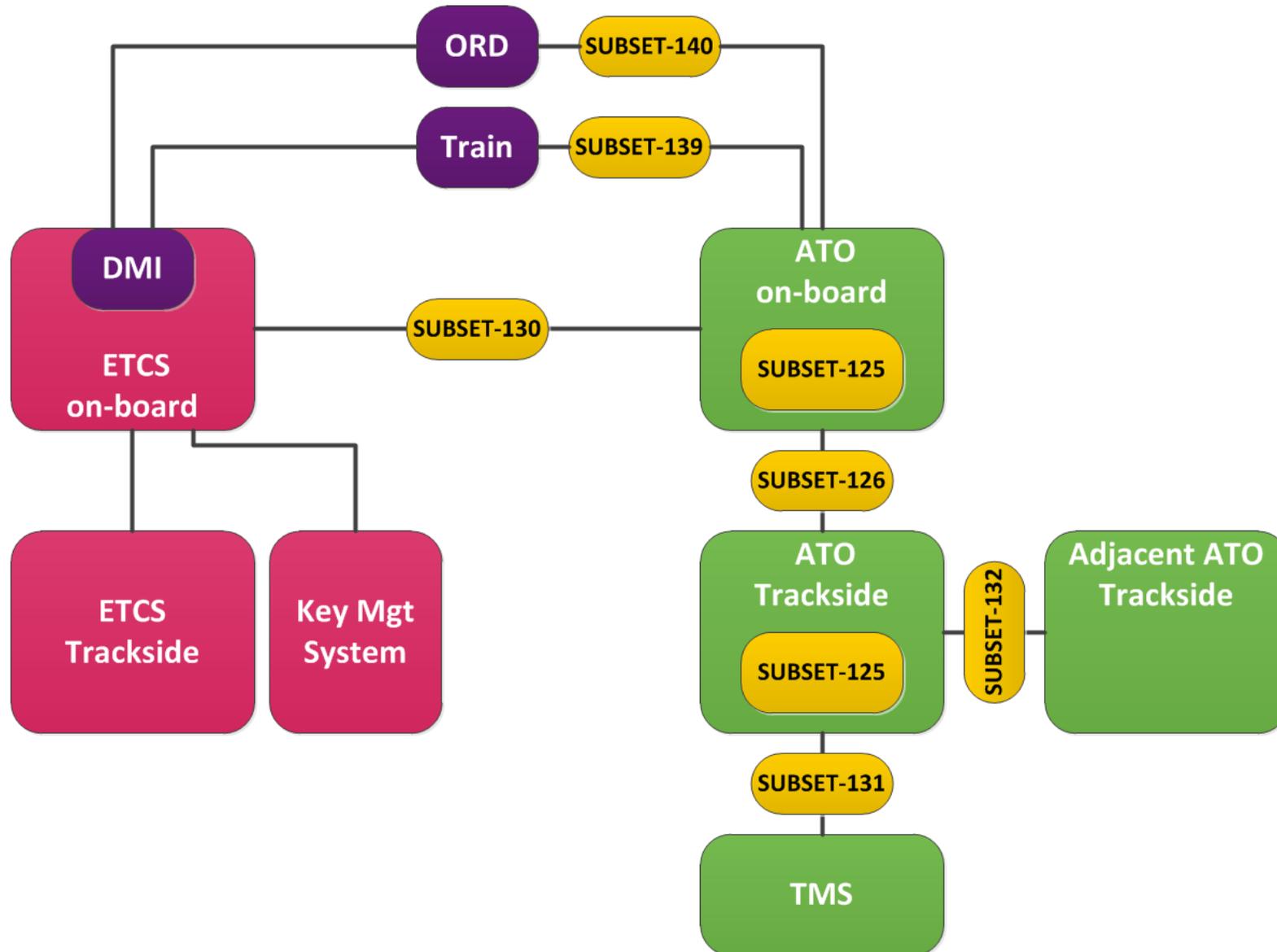


... lead to potential consumption of up to **42%**

Time line

TDs	TASKS	TRL	2016				2017				2018				2019				2020				2021				2022							
			Q1	Q2	Q3	Q4																												
TD2.2	Railway network capacity increase (ATO up to GoA4-UTO)																																	
	2.2.1 ATO over ETCS - GOA2 Specification	3-4																																
	2.2.2 ATO over ETCS - GOA2 Product Development	5-6																																
	2.2.3 GOA2 Reference Test Bench Demonstration	6																																
	2.2.4 GOA2 Pilot Line Demonstration	7																																
	2.2.5 ATO over ETCS - GOA3/4 Feasibility Study	3																																
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The first GRANT is limited to 2019 (blue part).



Involvement of the Agency

WP4 Meetings participation

- in order to validate overall consistency
- taking part in the review process of all ATO documents
- to approve potential impact on the CCS TSI (Annex A)

Guidance from the Agency on how the S2R development will link with the Change Control Management process through EECT meetings.

AoE architecture: to be agreed with The Agency

- **ATO over ETCS (up to GoA4) will permit**
 - To increase transportation capacity without huge infrastructure investment
 - To reduce energy consumption
 - To reduce operation costs
- **GoA2 already permit to achieve quick wins with limited impact on ETCS**
- **The involvement of the Agency is required**
 - to validate the interoperability and interchangeability of the ATO solution
 - to master the impact on ETCS



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ATO must be a business case for the actors involved

Border to be defined between Train Protection (ETCS) and ATO

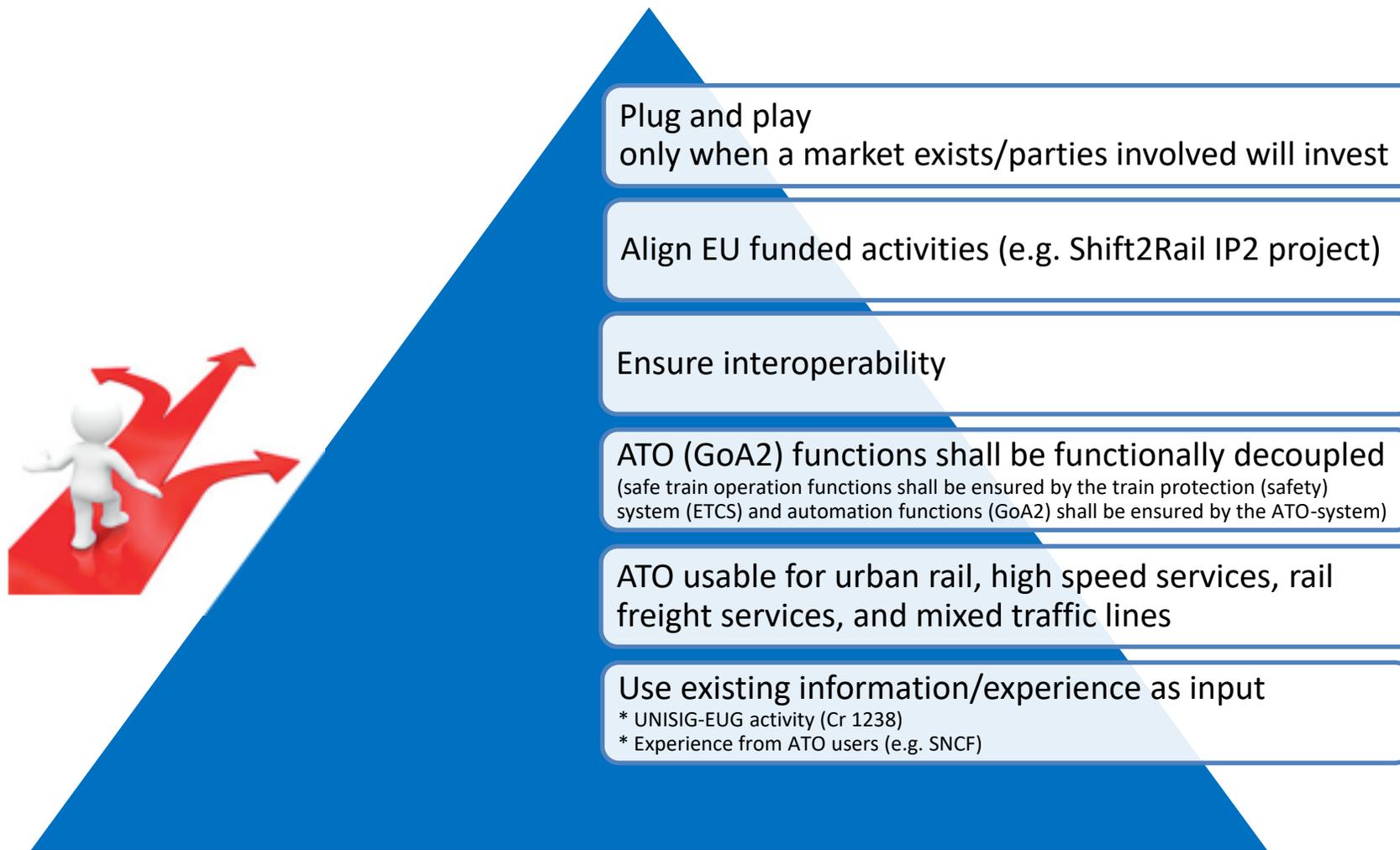
Impact on ETCS (e.g. ATO Icon or mode)

Making the rail infrastructure ready for ATO
(e.g. provide all relevant data, manage obstacles at tracks)

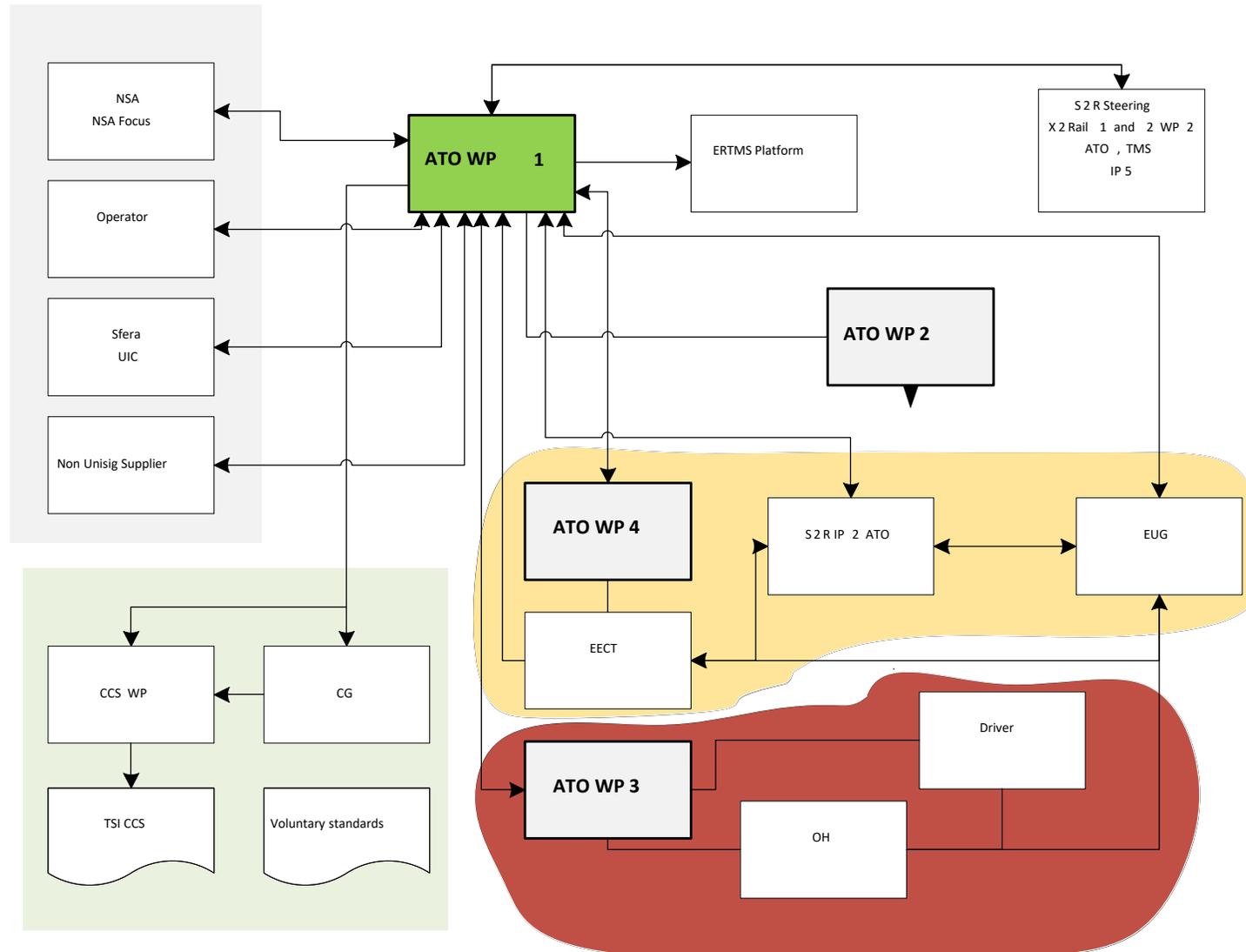
Interoperability

Retrofitting (especially for GoA4)

Migration



- › ATO must be interoperable,
- › It must be possible to operate in ATO GoA2 over the whole network,
- › It must be possible to have mixed operation (ATO and non ATO) on ATO lines,
- › Minimum impact solution on ETCS on-board for GoA2 must be possible too,
- › GoA2 train to be able to operate on a GoA4 line,
- › GoA4 lines must be able to manage GoA2 trains,
- › ATO is not safety relevant, the system safety is guaranteed by ETCS (GoA4?),
- › TSI CCS part for ATO should be optional,
- › The migration plans towards GoA4 system should be developed preserving max investment already made (stepwise approach).



- ATO (GoA2) planning EECT
- Review of
 - ATO SRS (Ss125)
 - FFFIS ATO on-board – ATO trackside (Ss126)
 - FIS (FFFIS) ATO on-board – ETCS (Ss130)planned to be finalised by March 2018
- Decision where to put
 - TSI CCS Annex A
 - Application guide
 - Voluntary “standards”the documents (Ss125, Ss126, Ss130, Ss.....) will be taken afterwards
- TSI CCS Annex A impacted documents
 - ETCS SRS (SS026),
 - ETCS Driver Machine Interface (ERA_ERTMS_015560)
 -
- TSI OPE Annex A (OPE rules) needs to be updated as well



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