

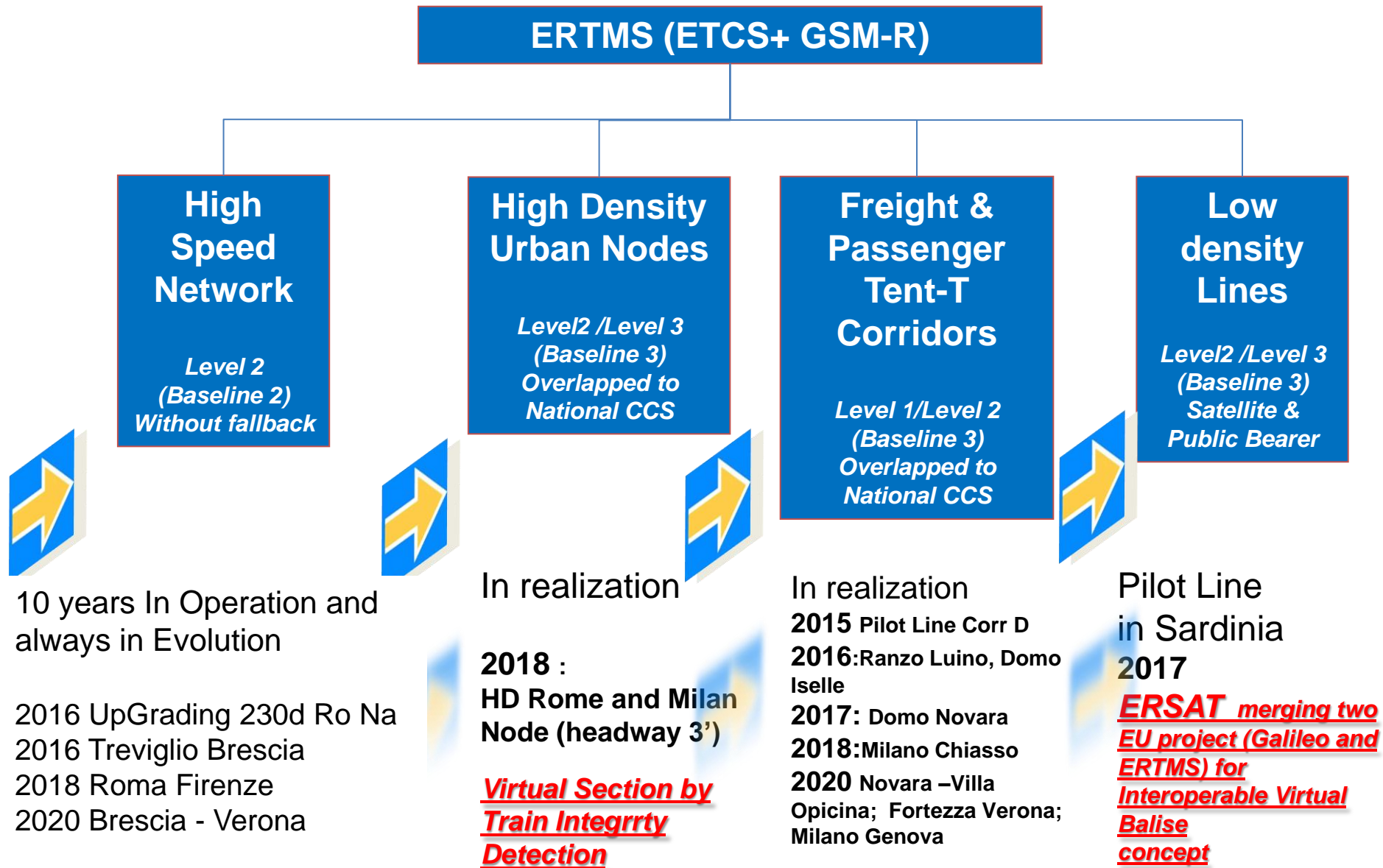


ERTMS for High Density in Urban Nodes

Principles of ERTMS L2 System with
high density functionality in the main
RFI urban railway nodes



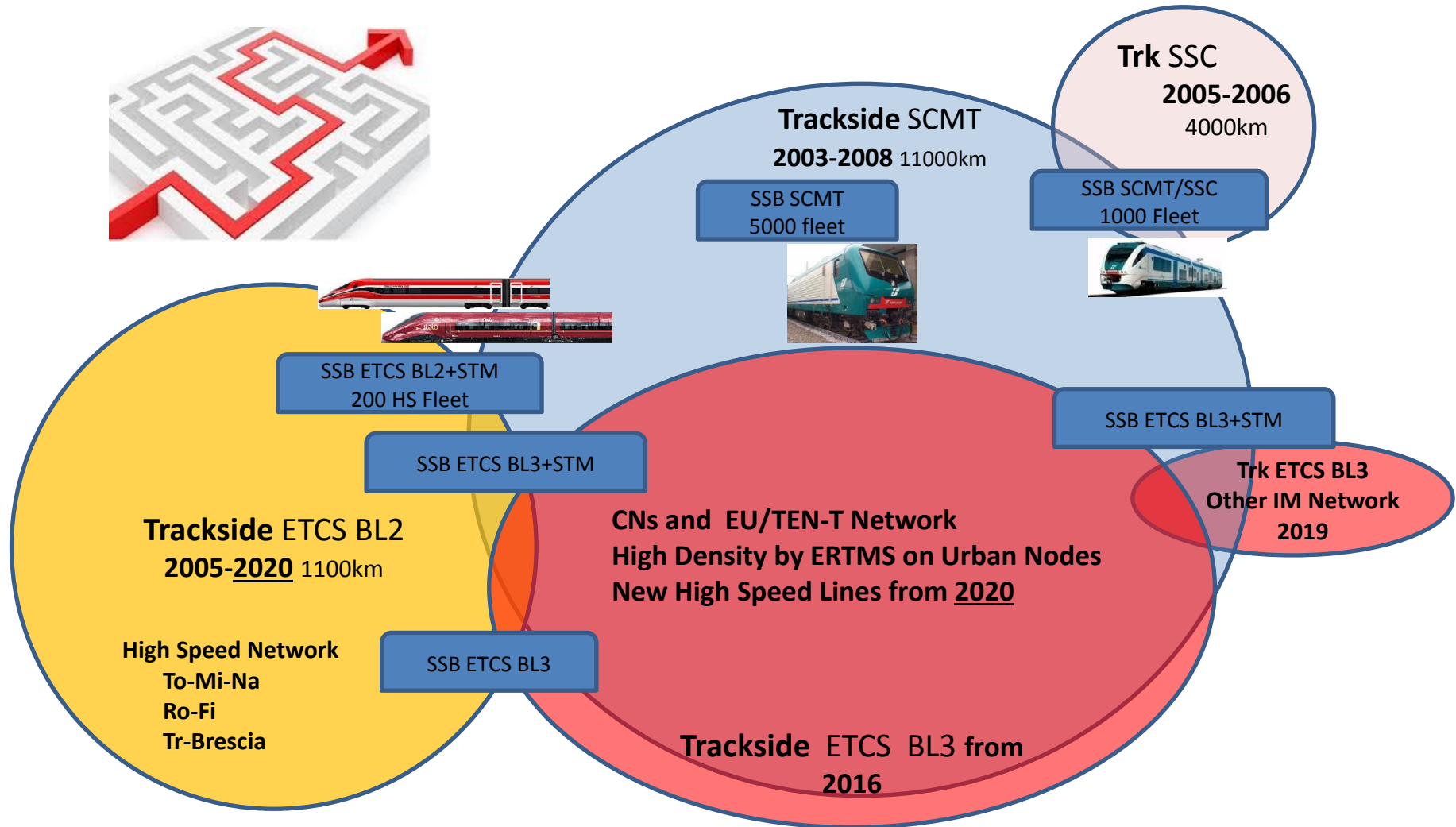
ERTMS in Italy : Obligation and Opportunities



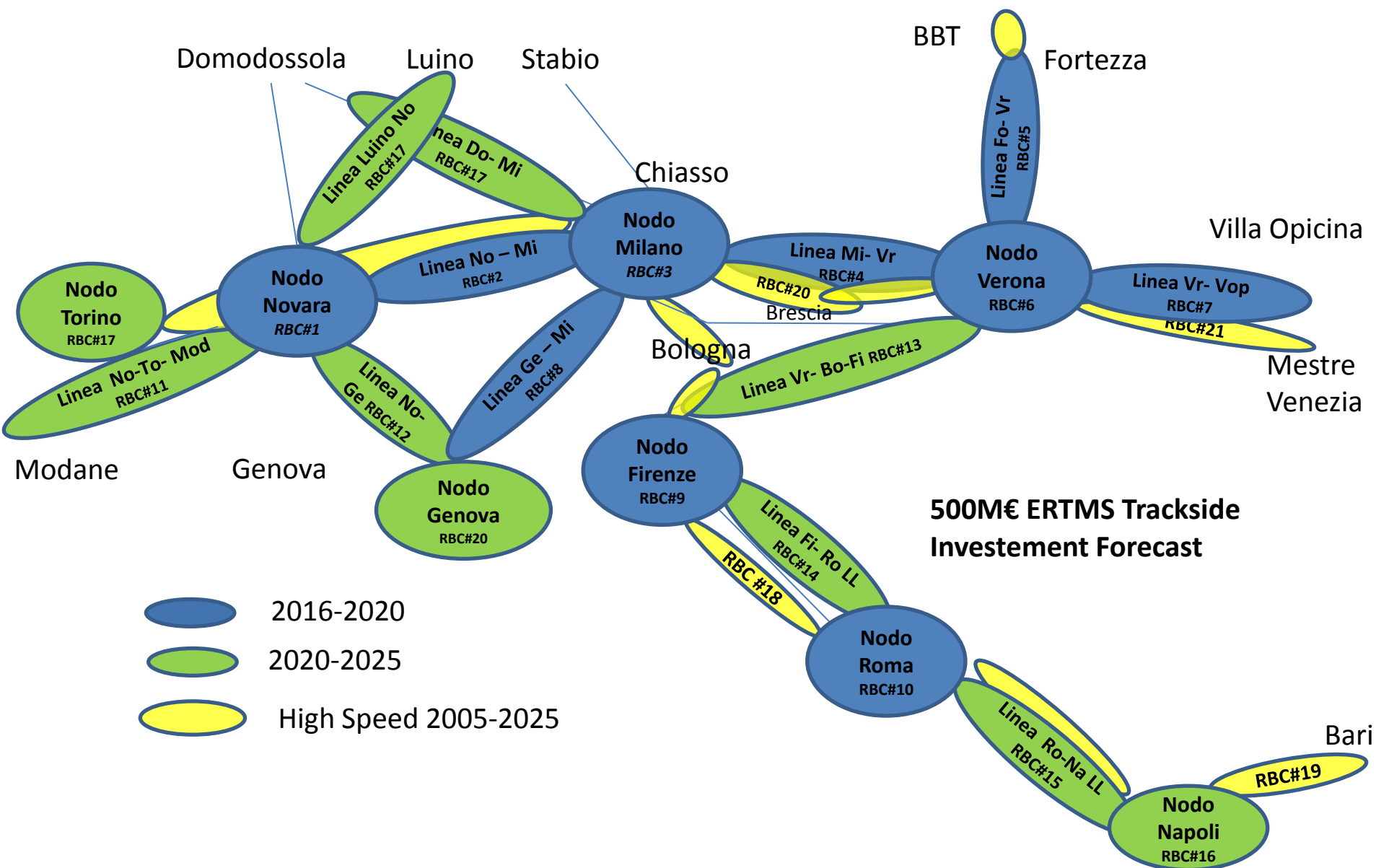
ERTMS Migration at 2030



CCS A and B in Italy : System Evolution for Interoperability and Intraoperability

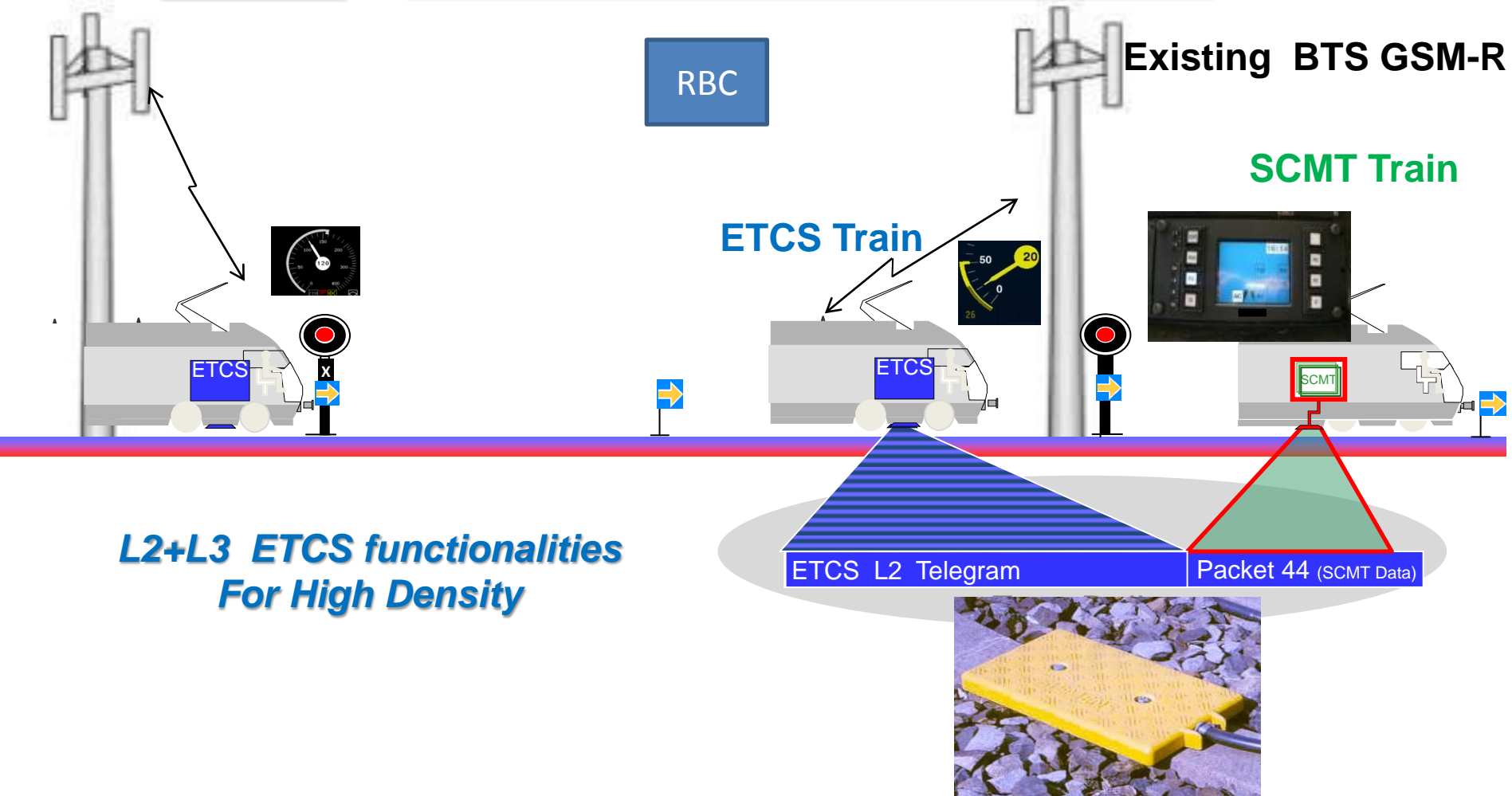


RBC Number for Nodes and Lines 2016-2025 ERTMS



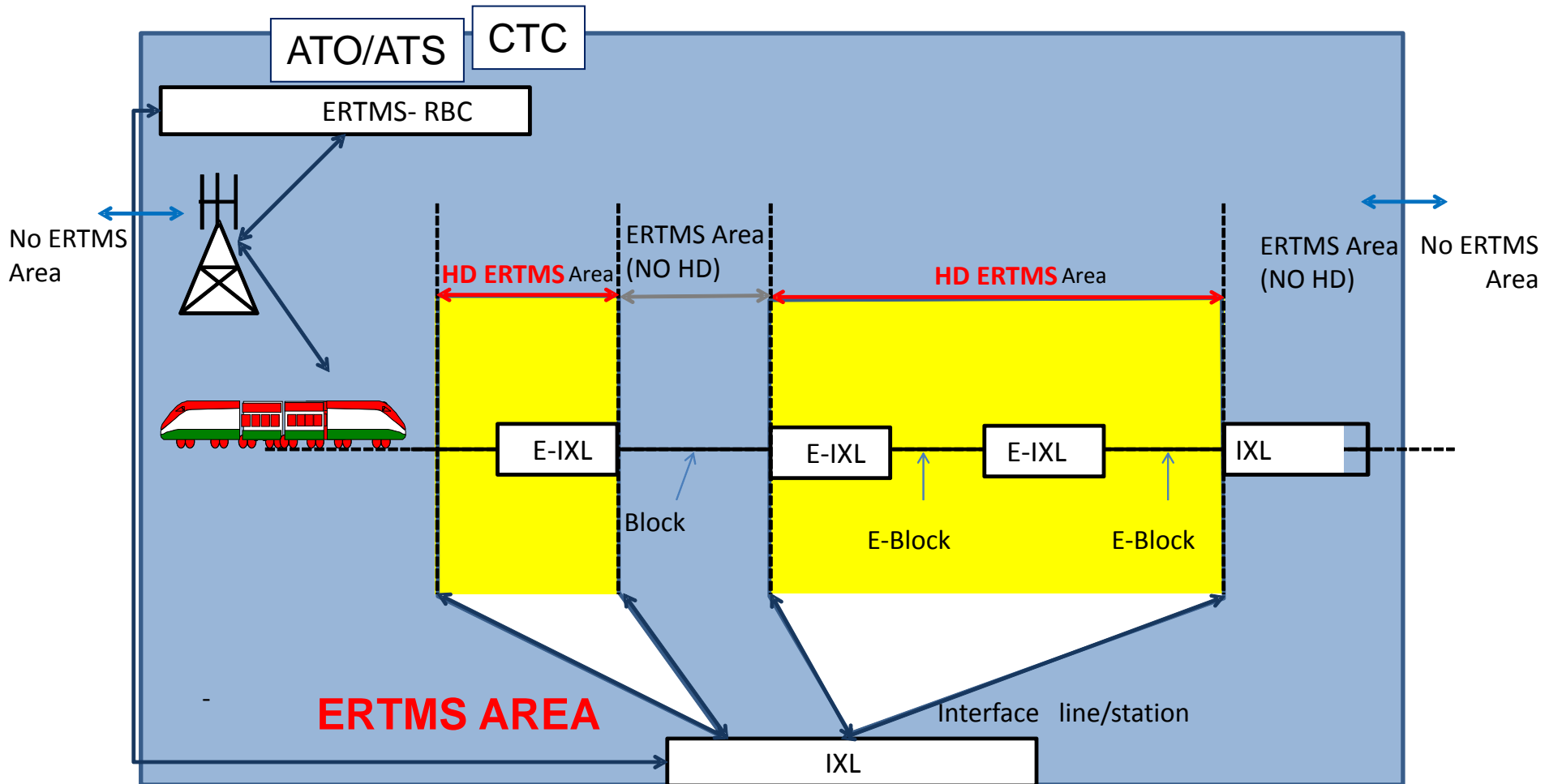
ERTMS/ETCS L2 overlapped at (Class B) SCMT

For CNCs and High Density (HD) in Urban Nodes



Existing Class B (SCMT) Eurobalises and Encoder

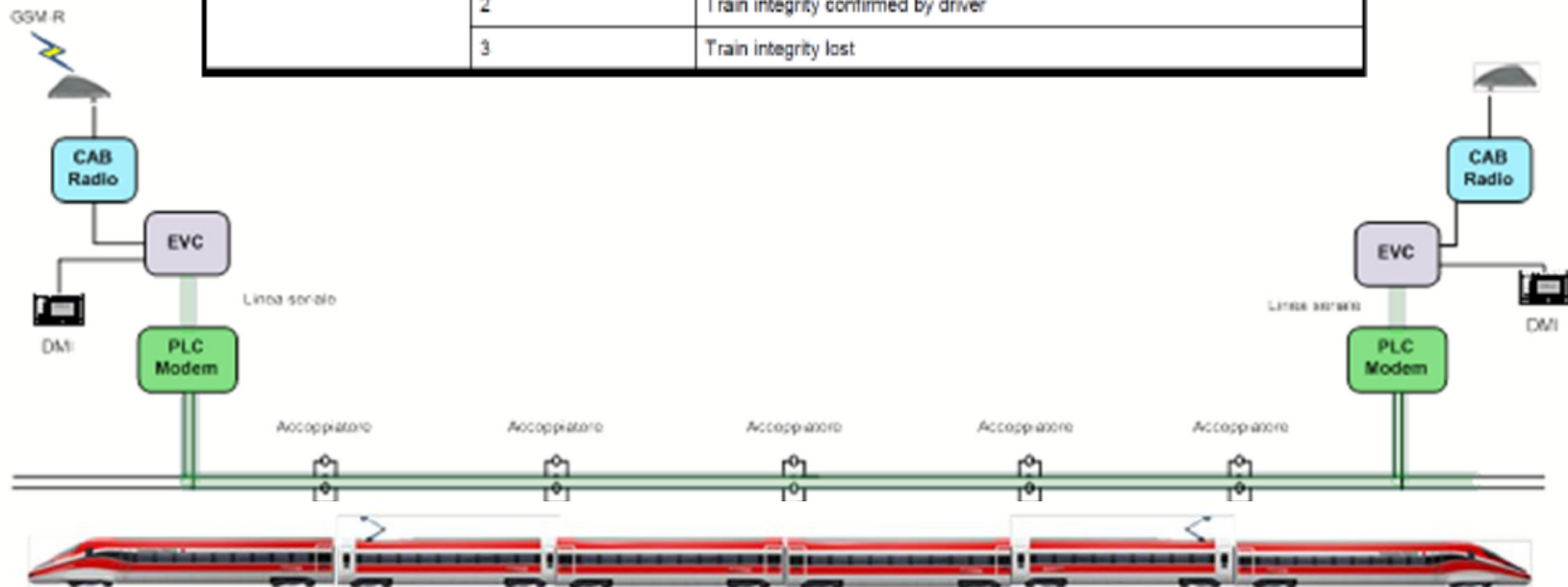
Architecture Principle

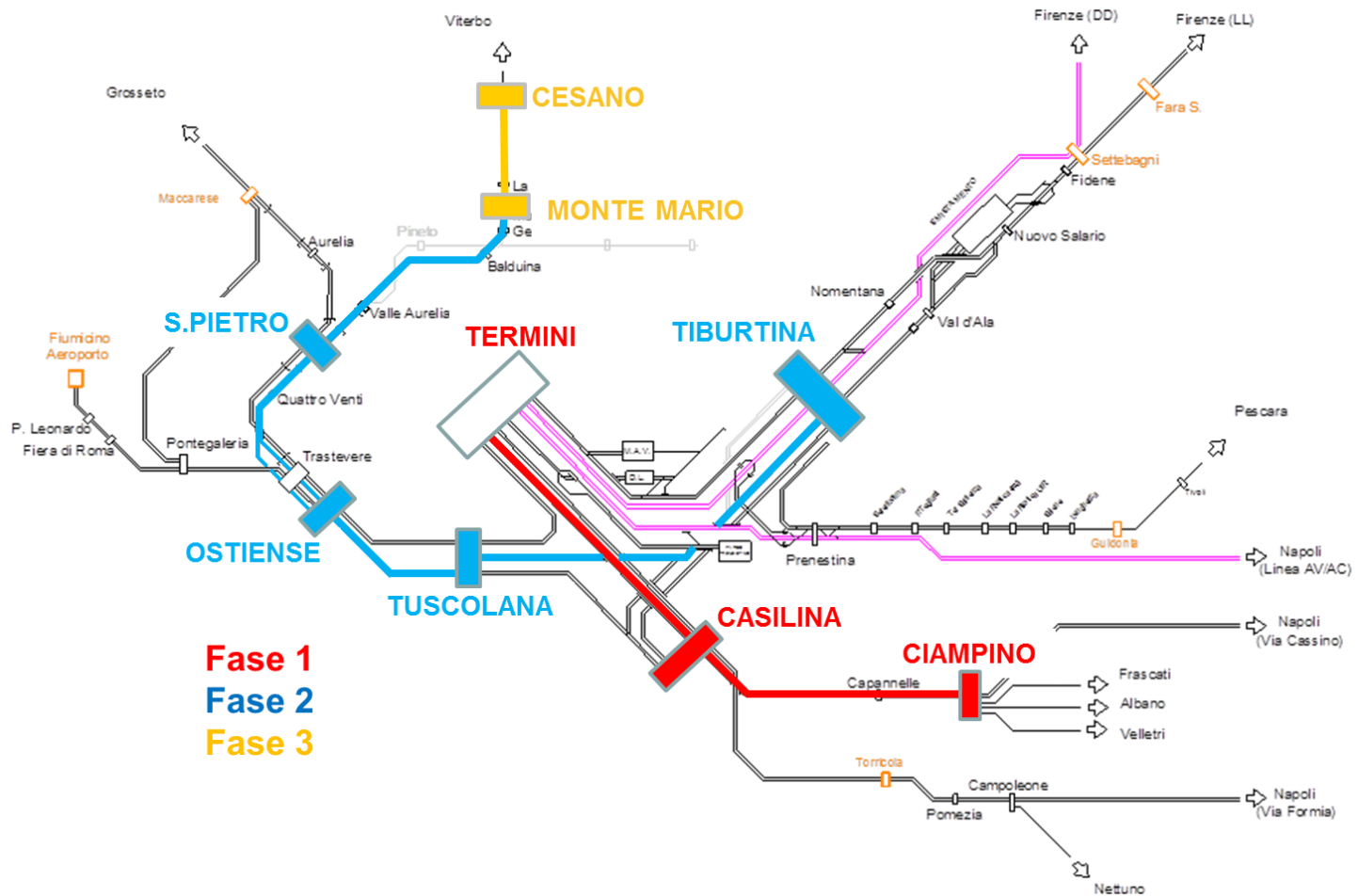


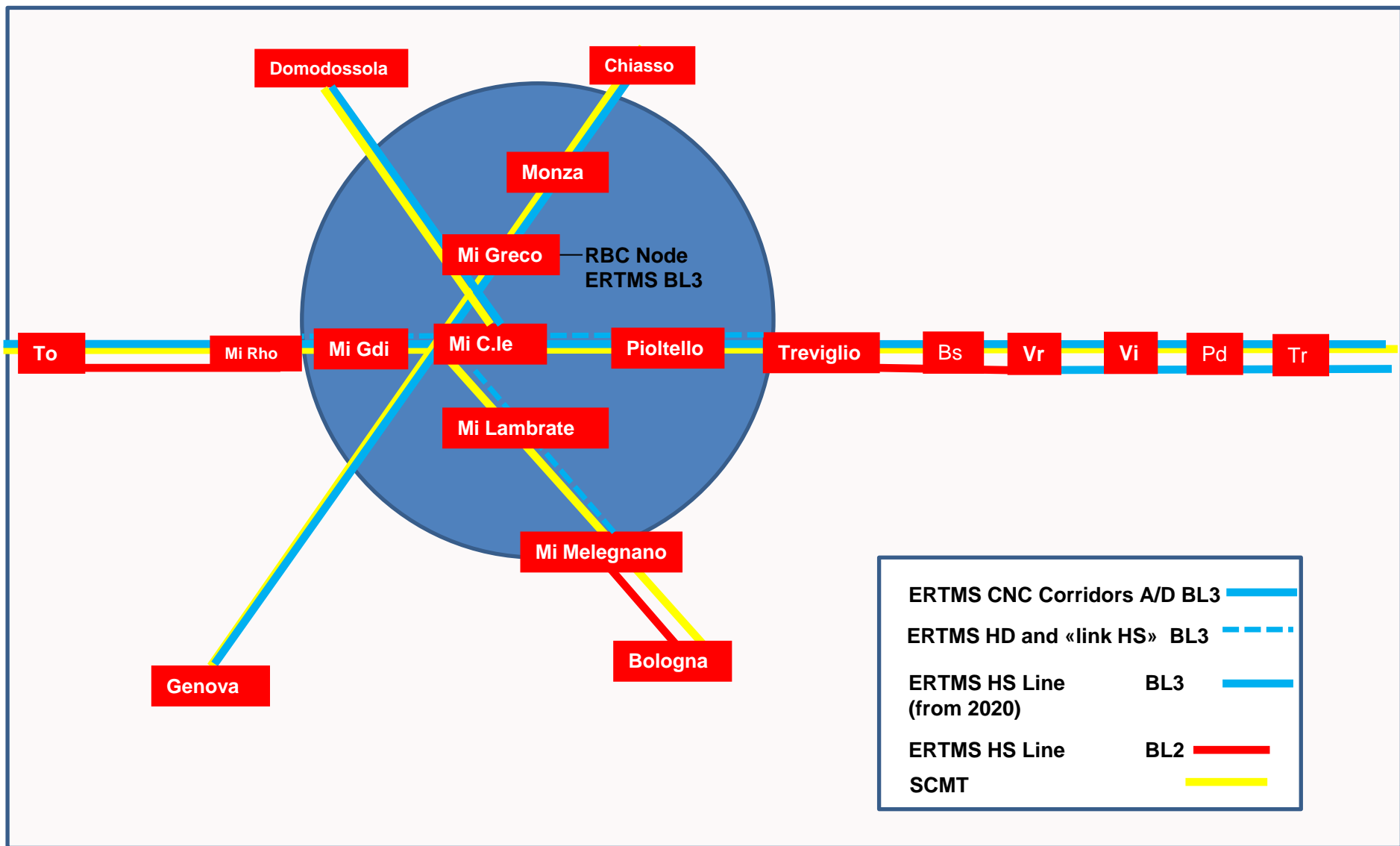
E-IXL: Electronic Interlocking
E-Block : Electronic Block

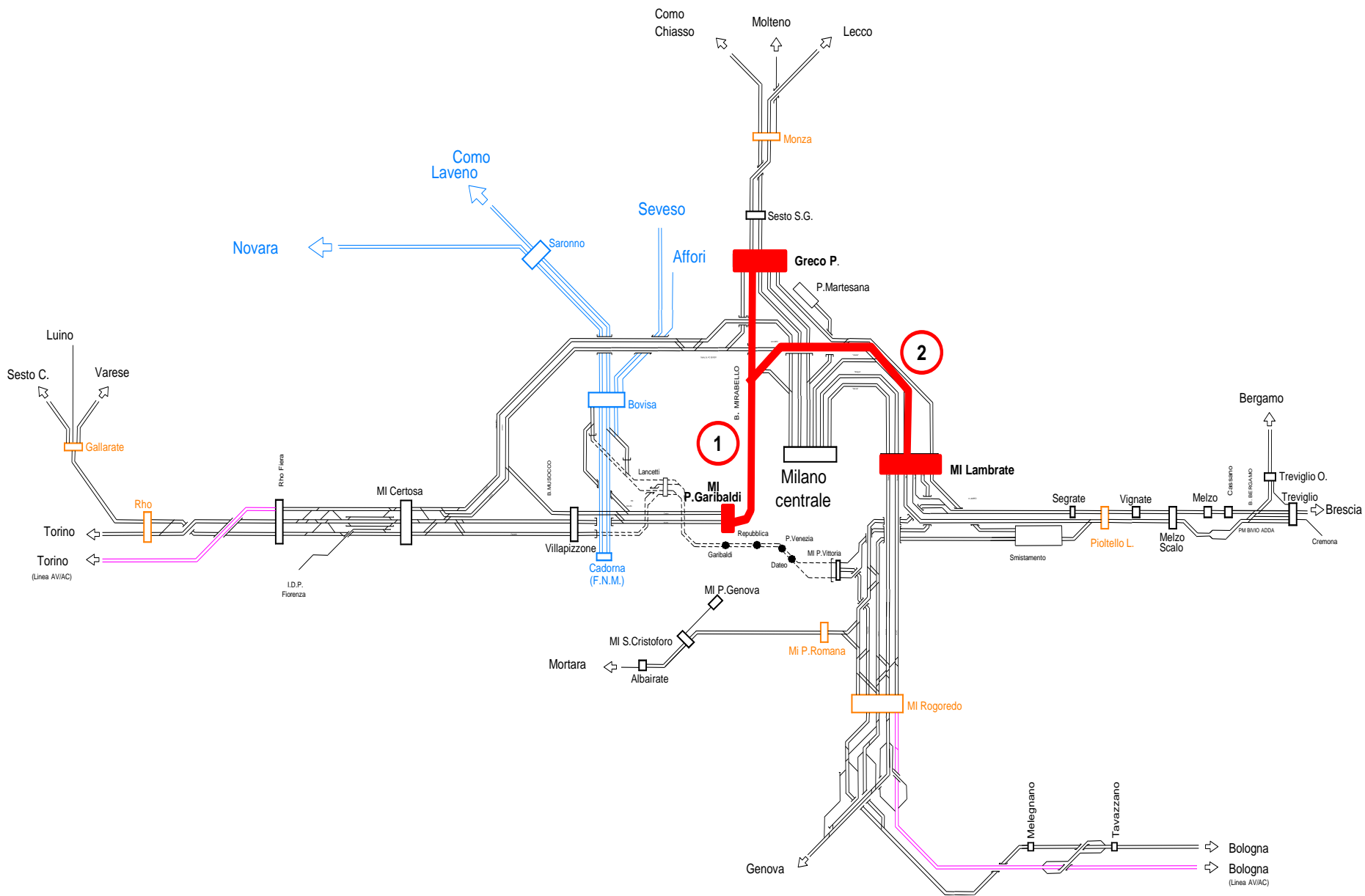
Train Integrity

Name	Qualifier for train integrity status		
Description	Qualifier, identifying the train integrity information available. The related safe train length information is given by L_TRAININT		
Length of variable	Minimum Value	Maximum Value	Resolution/Formula
2 bits			
Special/Reserved Values	0	No train integrity information available	
	1	Train integrity confirmed by integrity monitoring device	
	2	Train integrity confirmed by driver	
	3	Train integrity lost	

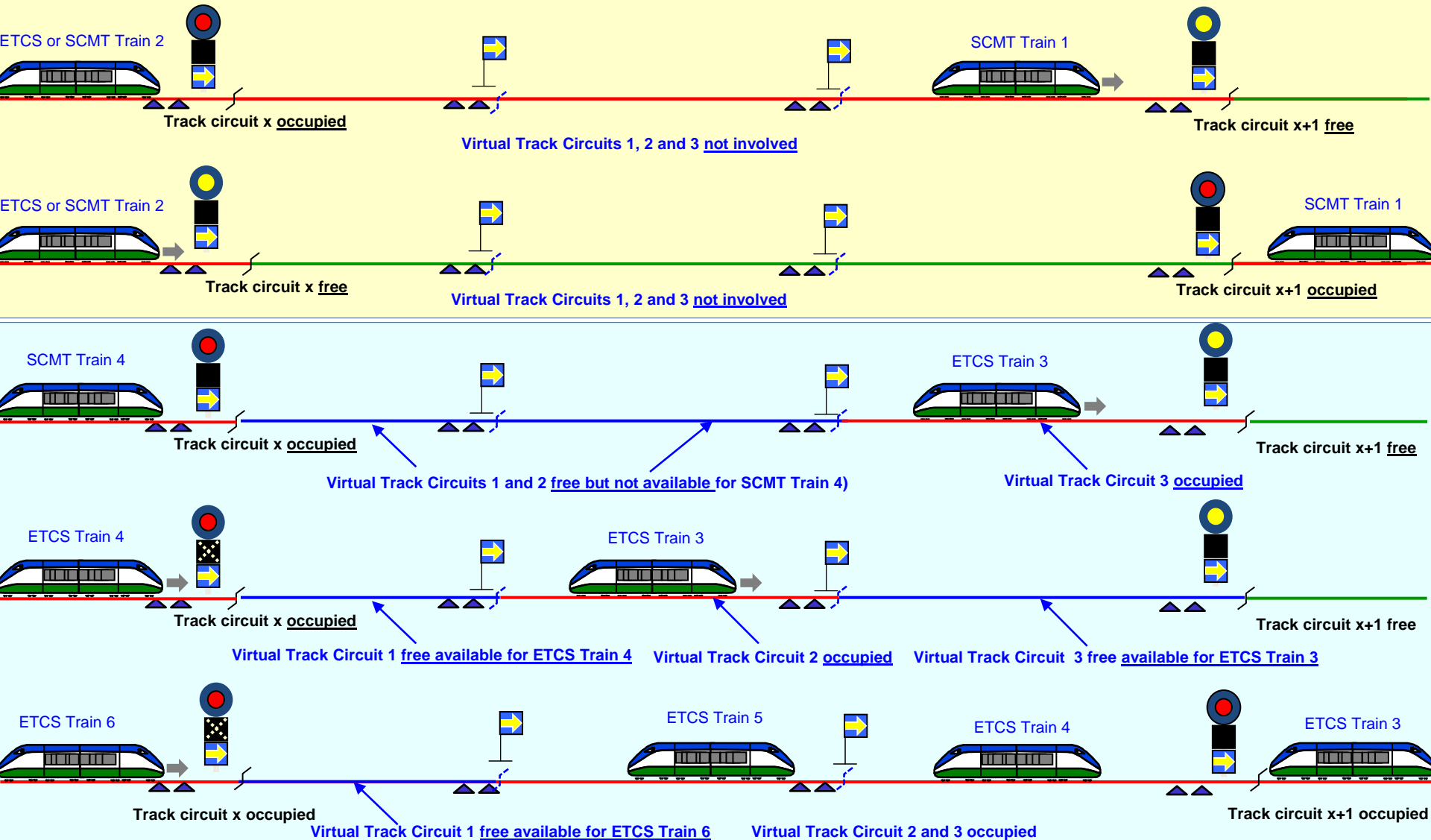








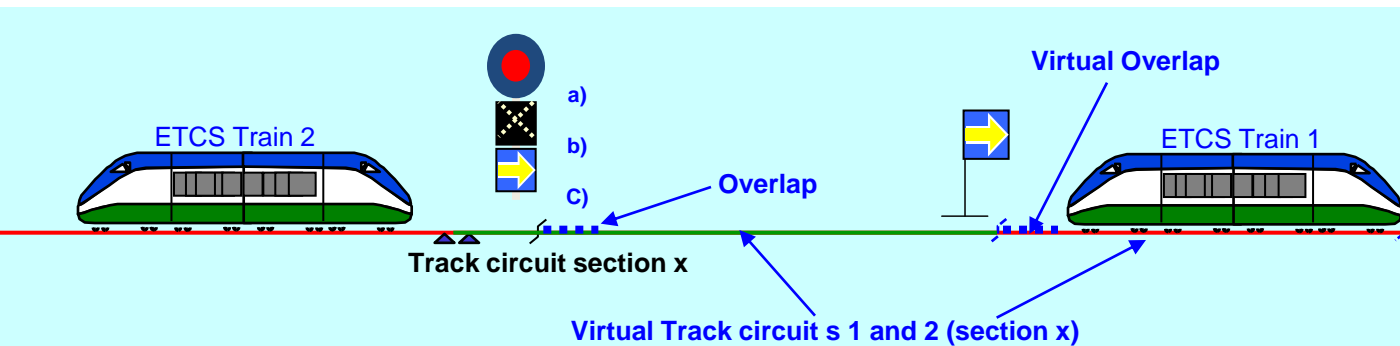
High Density: a new opportunity with ERTMS L2 + OB train integrity







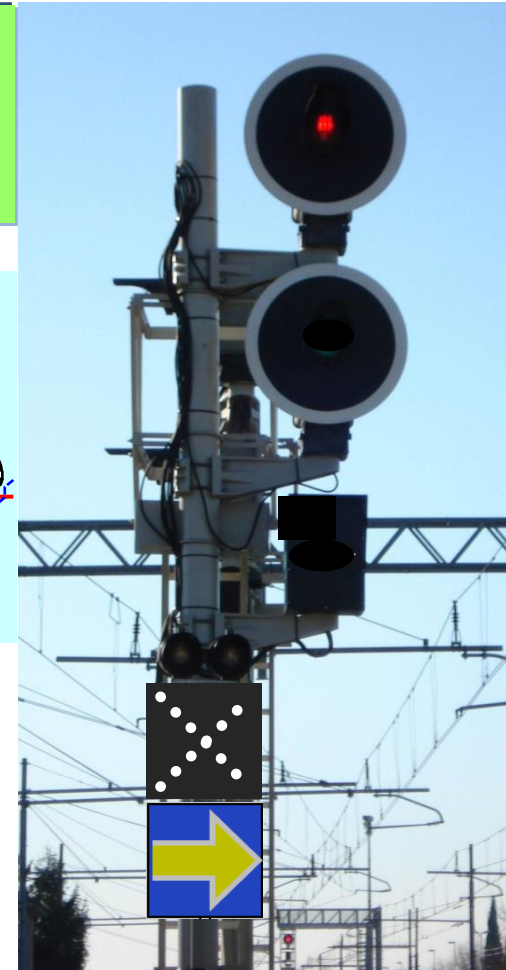
High Density main elements

Pre conditions for the High Density Function:

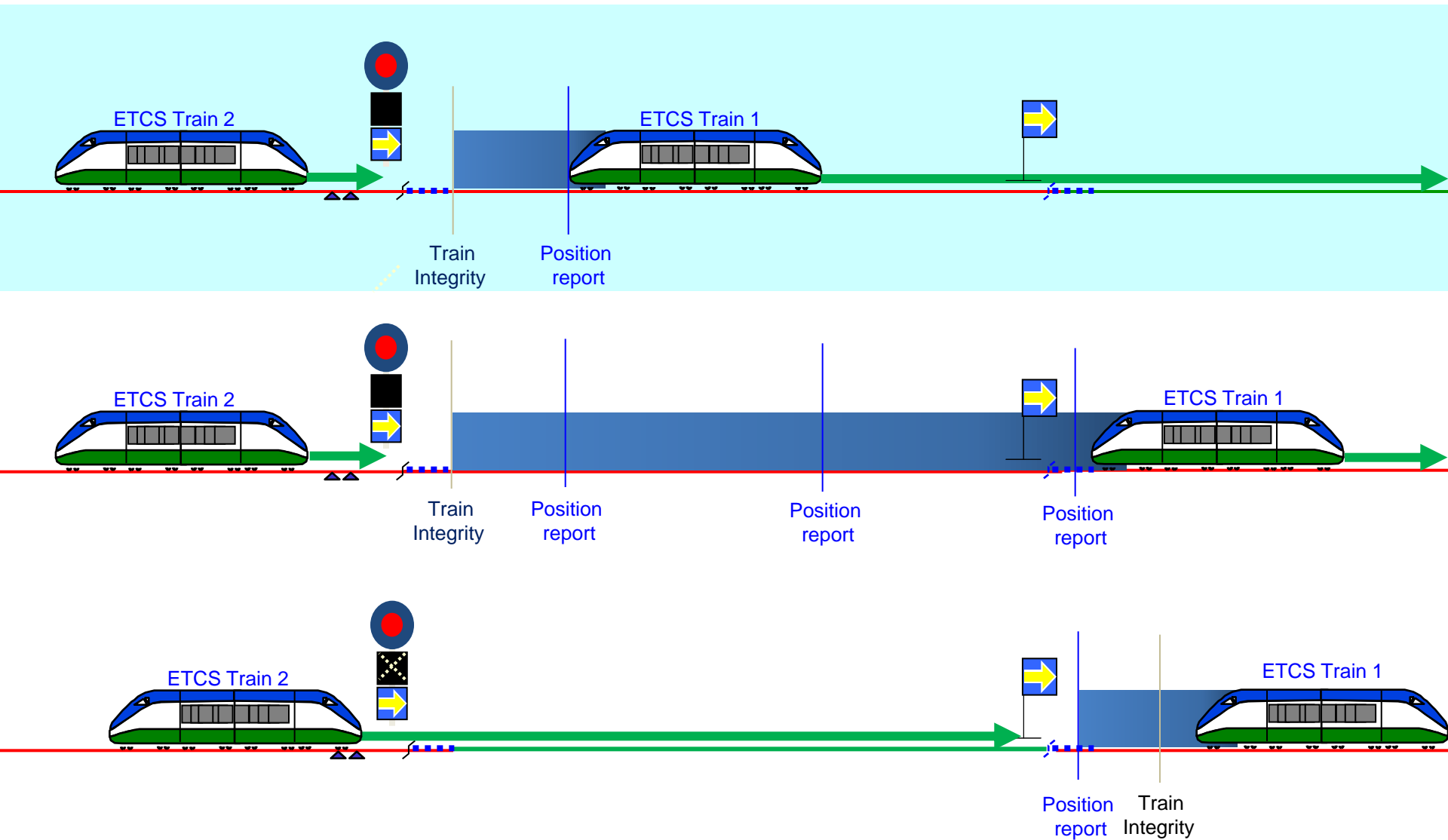
- ERTMS L2 Baseline 3
- The train running first (train 1) connected with RBC and with train integrity function active on-board
- Position report (after a Virtual Track Circuit) valid including the confirmation of the Train Integrity checked on-board
- The train 2, following the train 1, connected with RBC
- The signal c) with the symbol X active



- a)  Section x occupied
- b)  or  The train in front to the signal is an ERTMS train and there's an available MA for that train (from its current position to the first ETCS Stop Marker). Driver is asked to follow DMI info.
- 1) The train in front to the signal is not an ERTMS train and there isn't any available MA for that train Driver is asked to look outside and follow indication provided by signals.
 - 2) The train in front to the signal is an ERTMS train and there isn't any available MA after the signal Virtual track section 1 not yet cleared or an SCMT train is still occupying section x.
- c)  Line where ERTMS is over posed to the national signalling system



Train Integrity (On Board Function)



HD ERTMS System Requirement for Train and for EVC ERTMS/ETCS

HD ERTMS have to guarantee the high density headway only for chain of **trains** with this minimum characteristics (Gamma Trains) :

- Max lenght a 200 m;
- time delay for breaking system application < 4,5 s .;
- 140 % Weith Breaking;
- 1,0 m/s² average deceleration for EB in the speed range 0-100 km/h

The Train using the HD ERTMS functionalities must be use ETCS **EVC** BL3 R2 with:

- the “ETCS smart sleeping” functionality (without the breaking of the train in case of losing connection with tail EVC)
- Position Report (Q_lenght parameter) to RBC to check the safe tail of the train.
- Cab Radio for GPRS and MT with professional Filter agains interferences
- 0,9 the parametre of “rolling stock correction factors”

Increase Average Speed: Emi Path and virtual overlap

N° of sections	L- Movement Authority	Distance EoA – SL (overlap)	Nominal Speed
1	350 m	≥ 50 m	30 km/h
		≥ 100 m	40 km/h
2	700 m	≥ 50 m	85 km/h
		≥ 100 m	90 km/h
3	1050 m	≥ 50 m	120 km/h

Different ERTMS Levels , Baselines and Suppliers

Guarantee the System integration : lab ERTMS IM (RFI)



EVCs BL3

