On 5G projects for urban railways and Russian Digital Economy program

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Outlook

1. System 5G in Russian Digital Economy program
2. What kind of signaling for Moscow Central Diameters
3. GSM-R basics
4. GSM-R Architecture
5. On Russian-Chinese co-operation
6. On 5G for railway
7. Conclusion: on 5G implantation cost

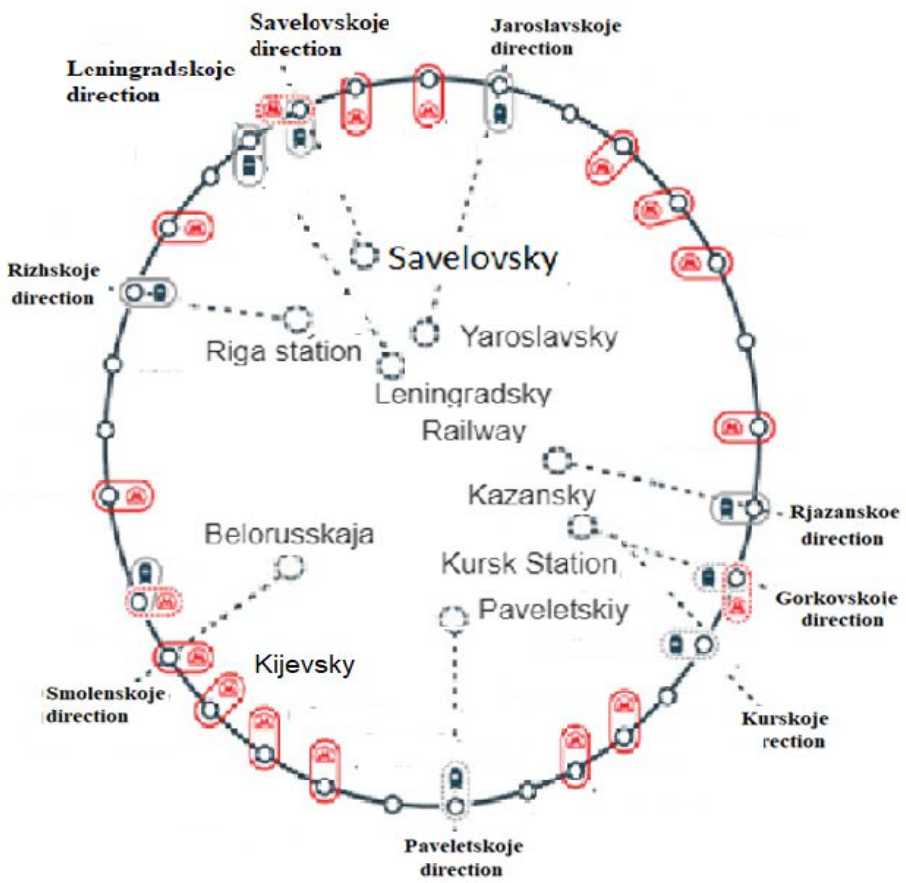
1.System 5G in Russian Digital Economy program

1) the target status for 2018: the frequency resource for the deployment of 5G networks,

2) the target situation for 2020: 5G communication networks are implemented in all cities with a population of more than 1 million people,

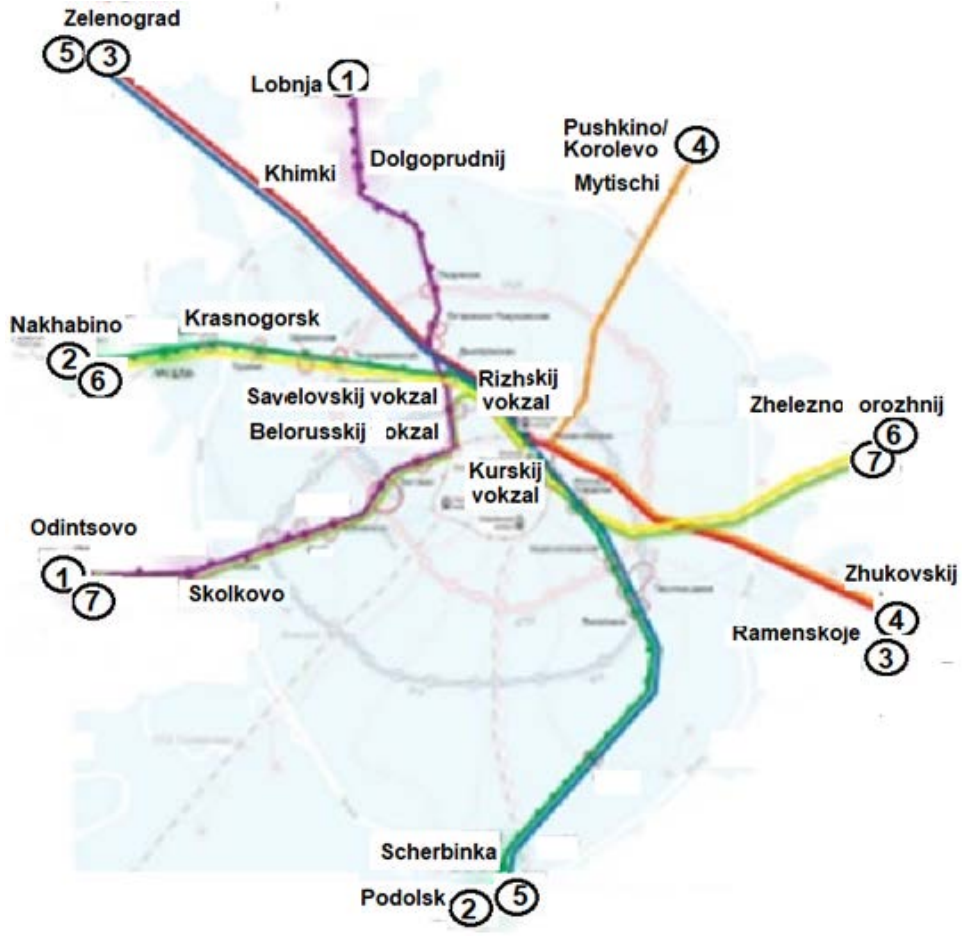
3) the target status for 2024: a wide commercial use of 5G networks,

2.Moscow City railways
Central Circle



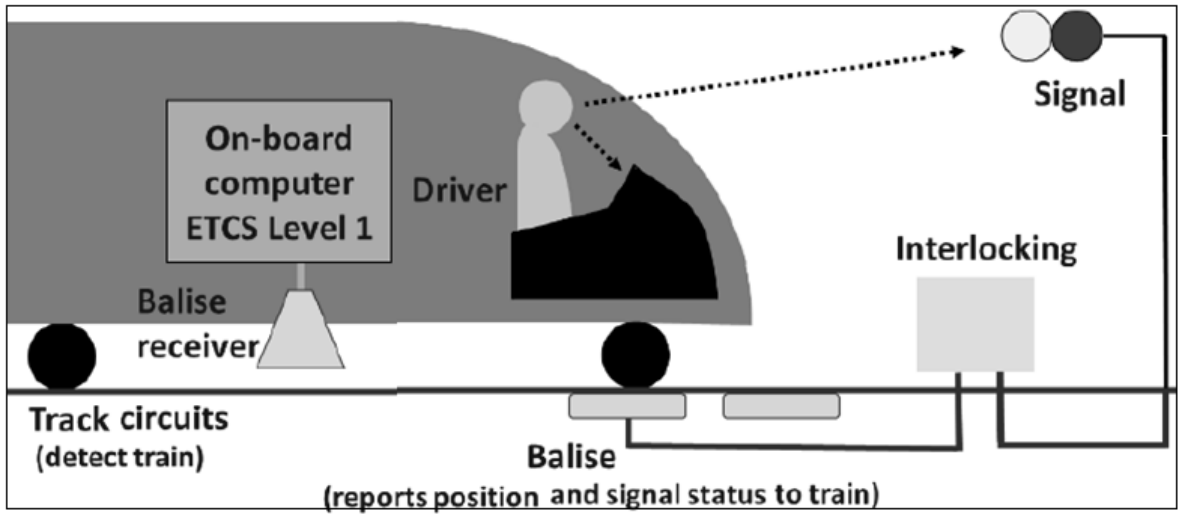
The Moscow Central Circle line is operated by 61 Siemens ES2G *Lastochka* trains and controlled by GSM-R.

Moscow Central Diameters



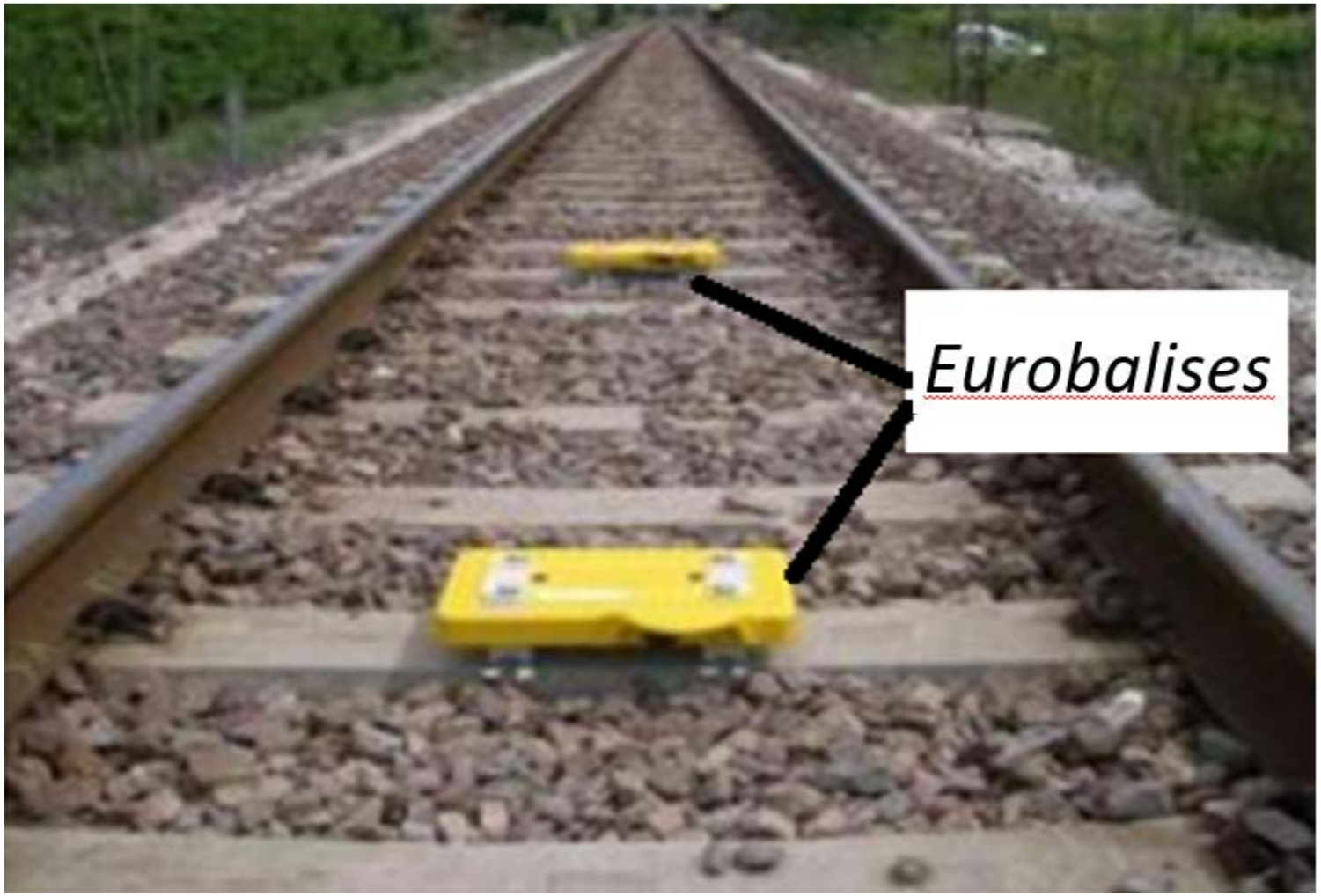
In 2017, Moscow announced plans to create links between the existing radial rail routes into the city

3.GSM-R basics

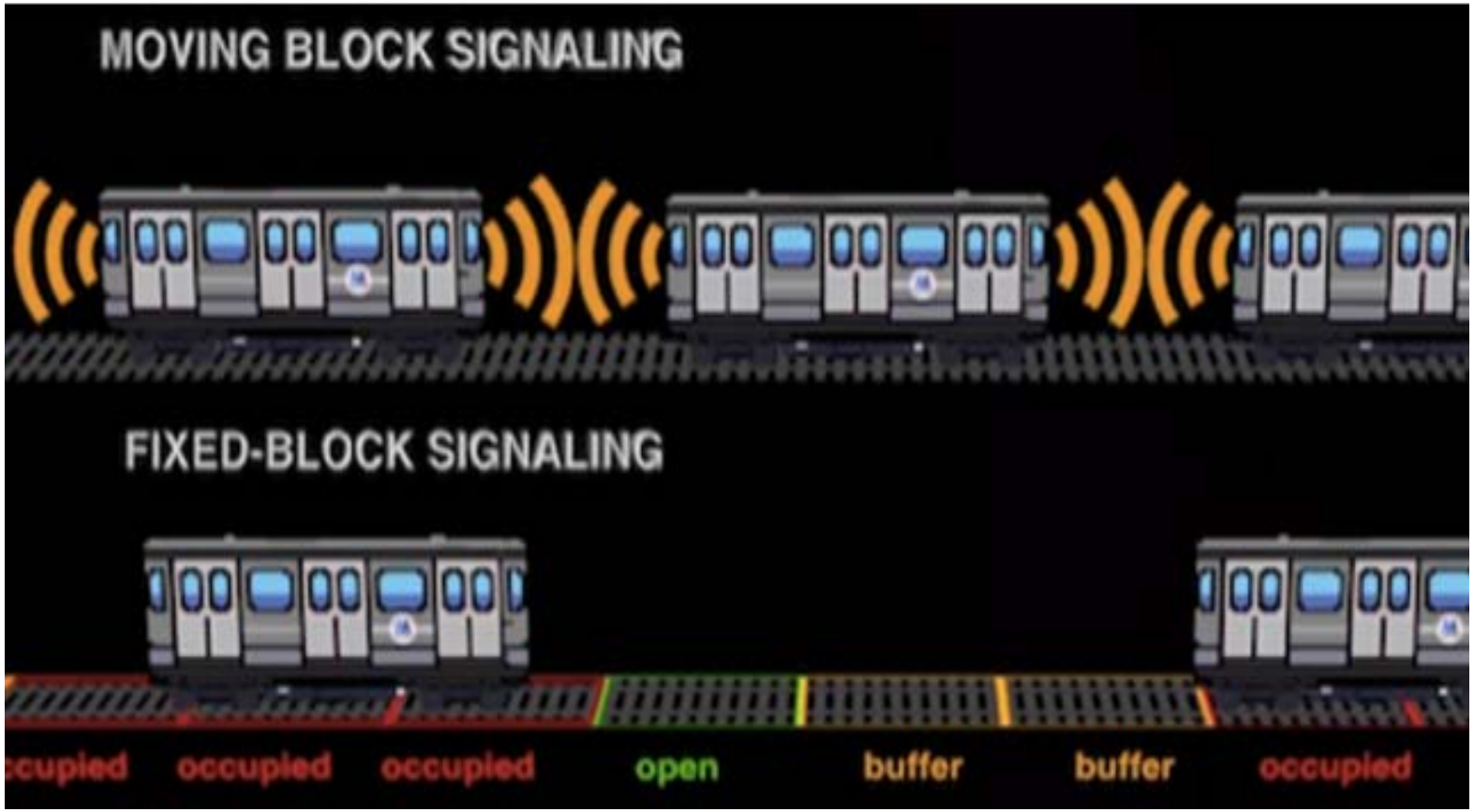


Three main components:
1) the computer in the driver's cab - **Eurocab**, which is connected to the GSM-R terminal installed on the train ,
2) **Eurobalises**, or in other words, track transponders, which determine: the location and speed of the train, as well as the characteristics of the path at a given location: curvature of the path, speed limits, etc.,
3) **Euroradio**, a system of continuous radio communication between the train and the control center via the GSM-R network

Eurobalises

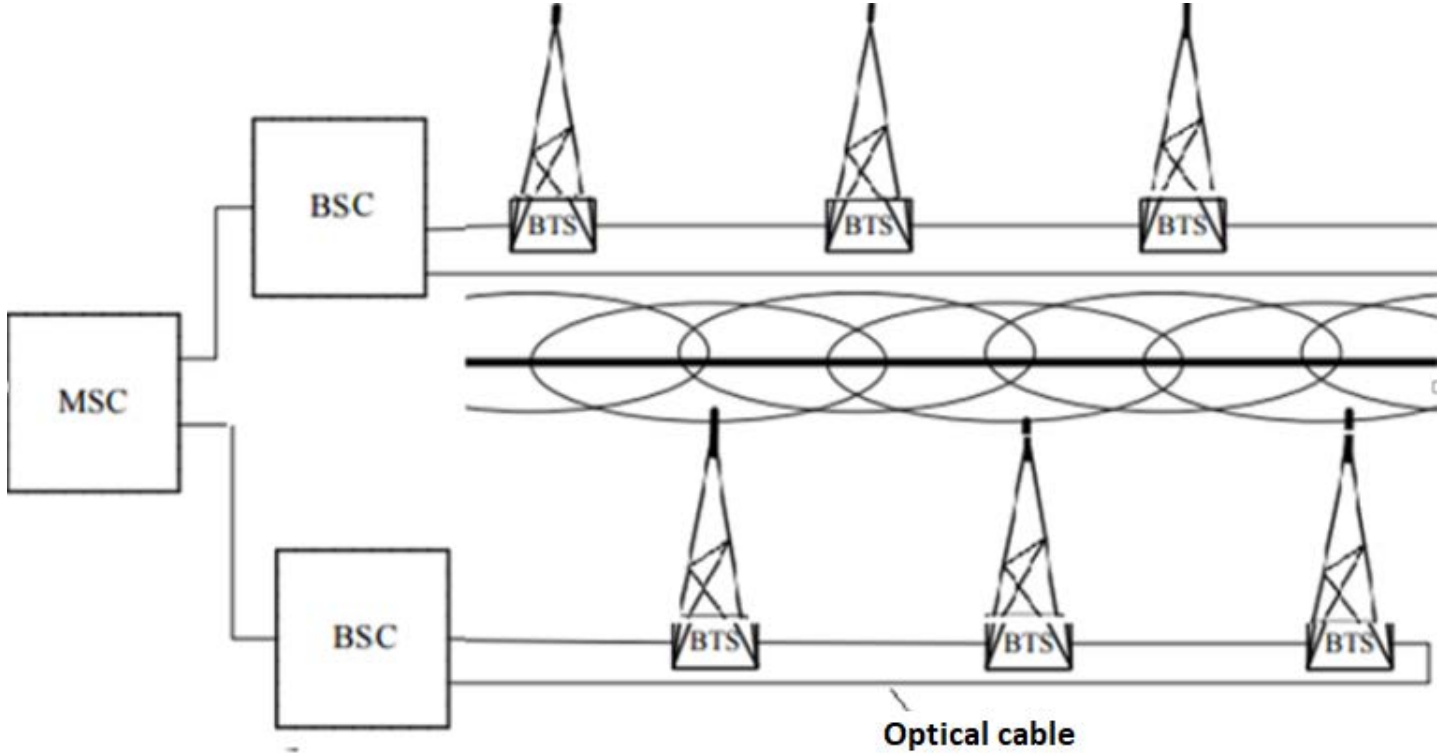


Comparison of two methods of path signaling



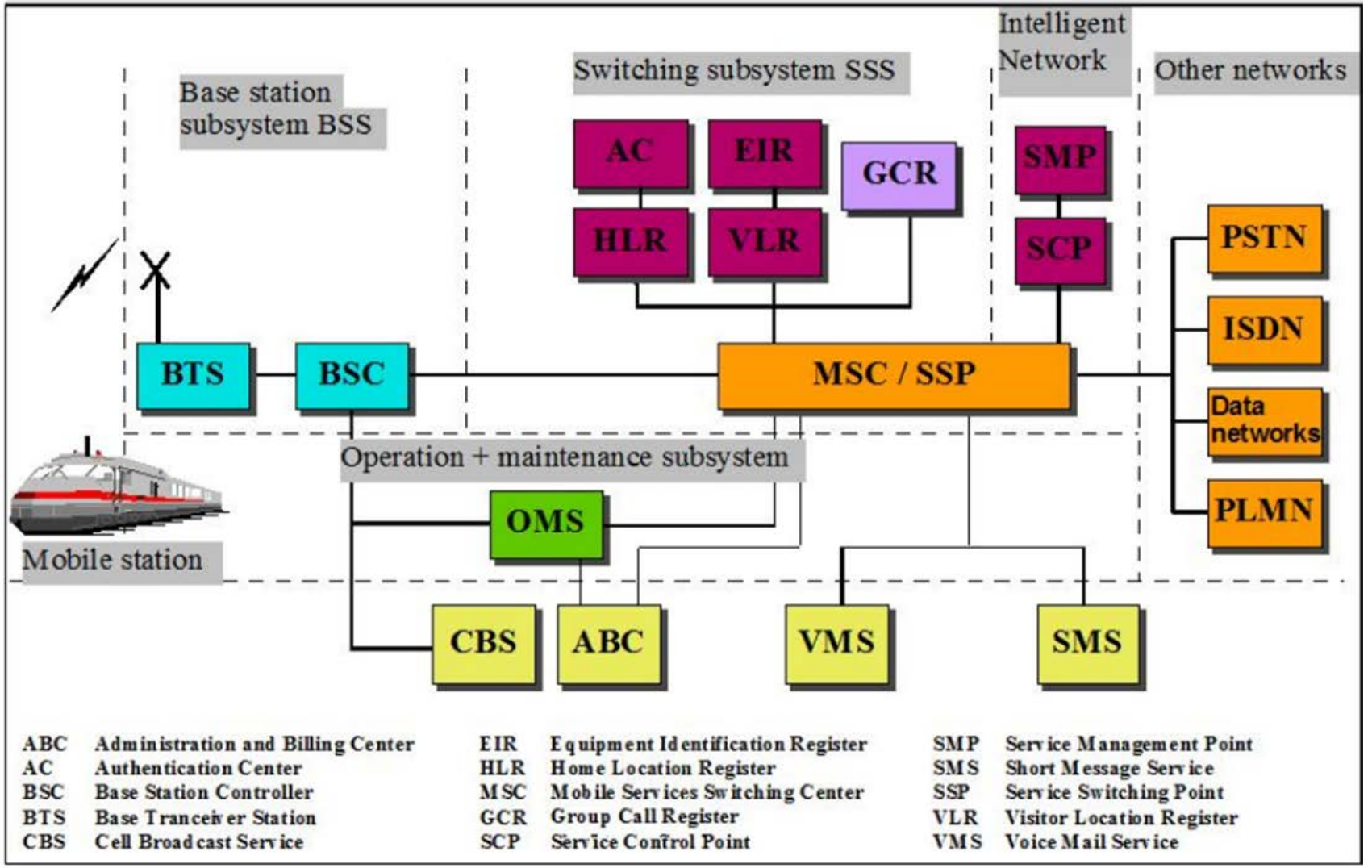
Increase in the carrying capacity of paths up to 40%.

Two sets of alternating BSC base stations with a ring connection over optical cables

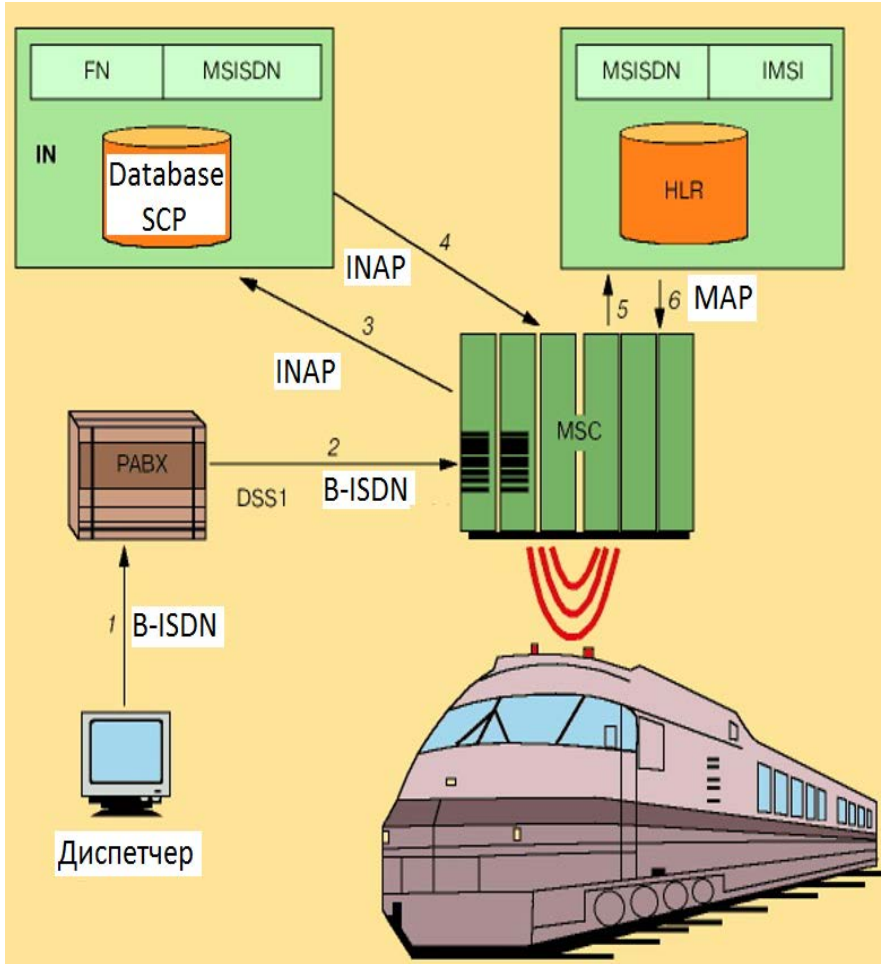


BTS - Base Transceiver Station
BSC - Base Station Controller
MSC - The central mobile switch (analogous to a large telephone node) serves a group of zones

4.GSM-R Architecture



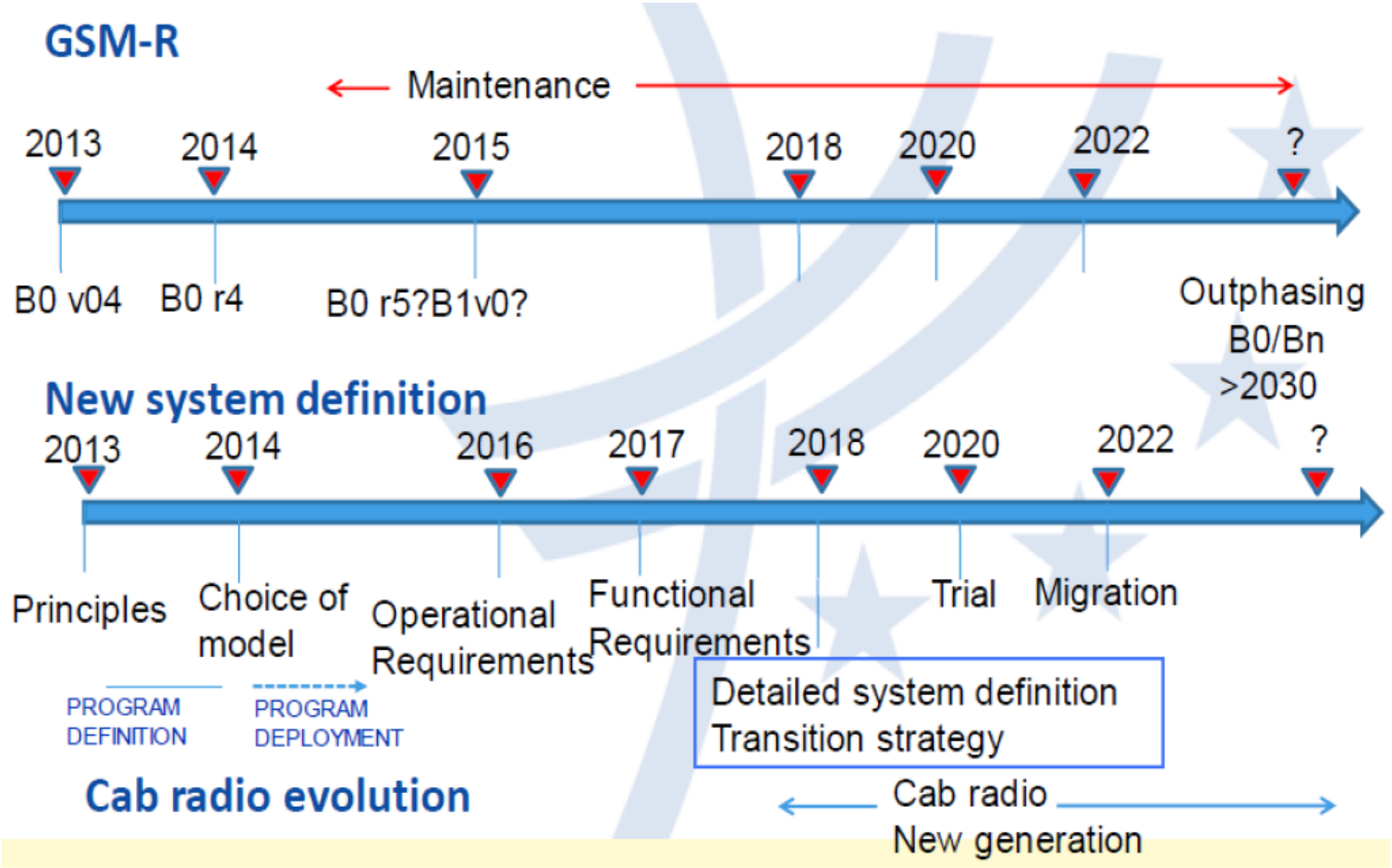
Functional addresing



MSISDN (Mobile Subscriber Integrated Services Digital Number)

International Mobile Subscriber Identity (IMSI)

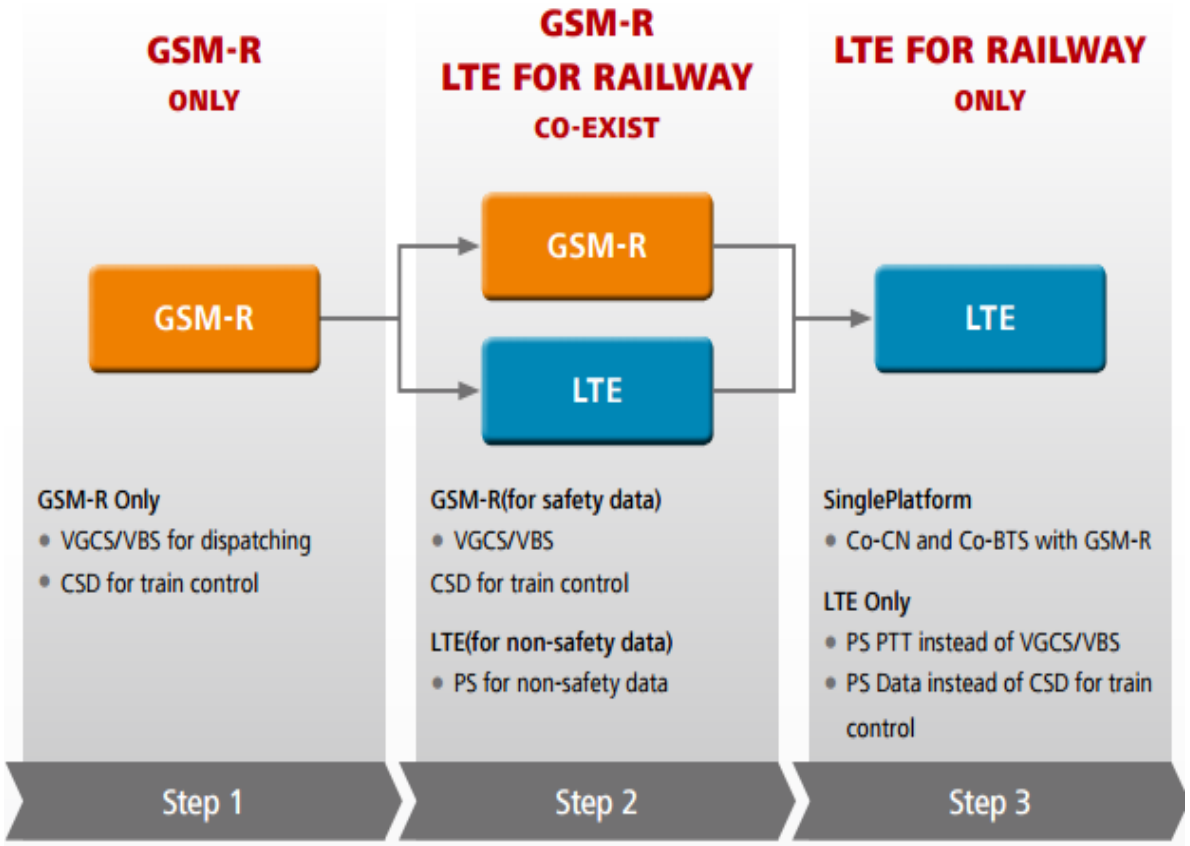
5.On Russian-Chinese co-operation



Source: ERA (Lille, 11 February 2015)

The way forward: cab radio evolution: GSM-R predicted obsolescence by 2030

Huawei Technologies Strategy

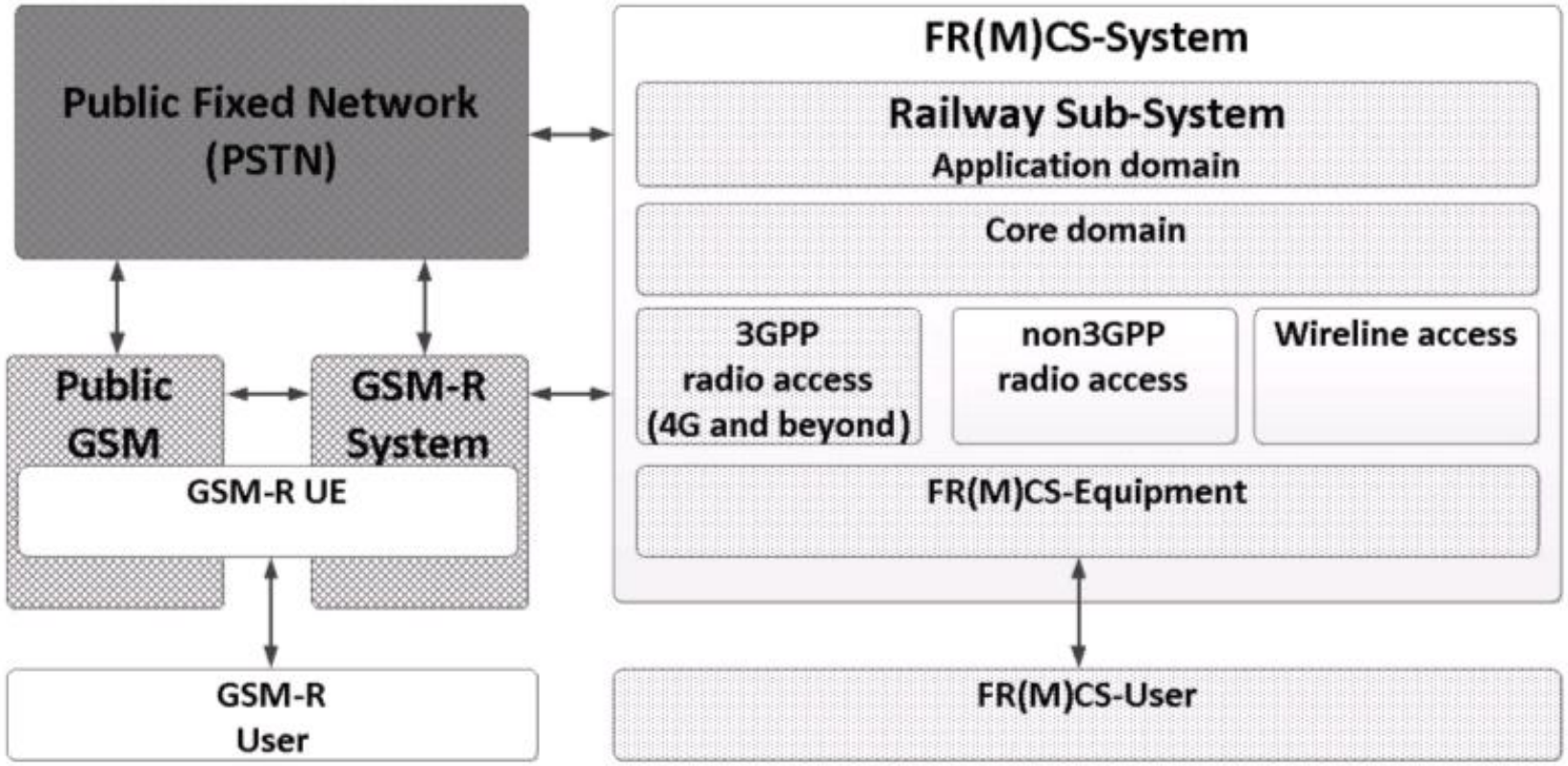


GSM-R in Russia

Source: Washington Post, 2014/11/21

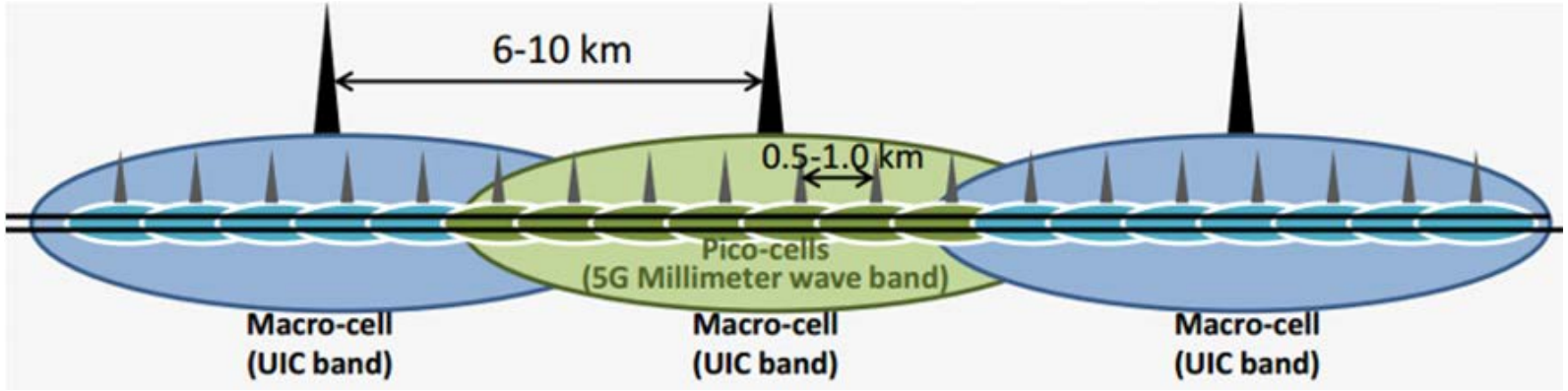
6.On 5G for railway

TR 22.989 ‘Study on Future Railway Mobile Communication System’ Technical report

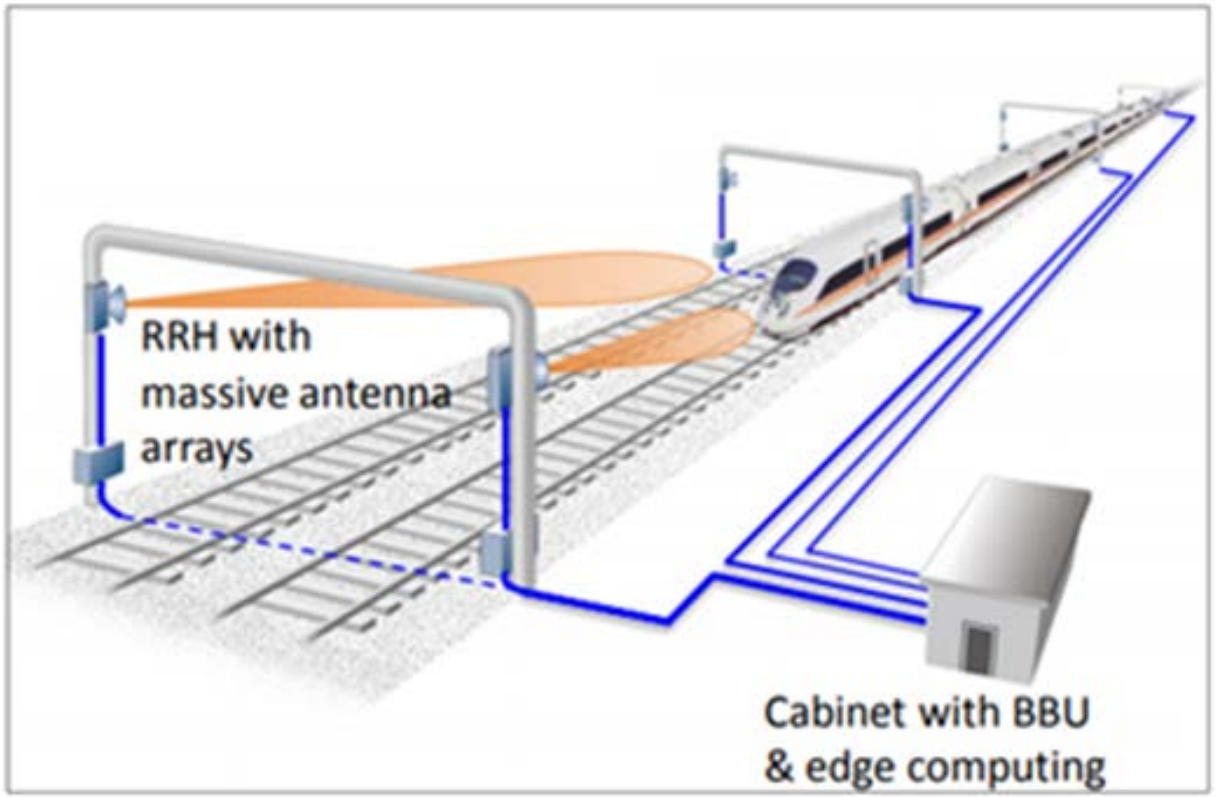


TR 38.913 ‘5G RAN Scenarios and Requirements’ describes the various train-specific deployment scenarios for a future 5G radio access network (RAN).

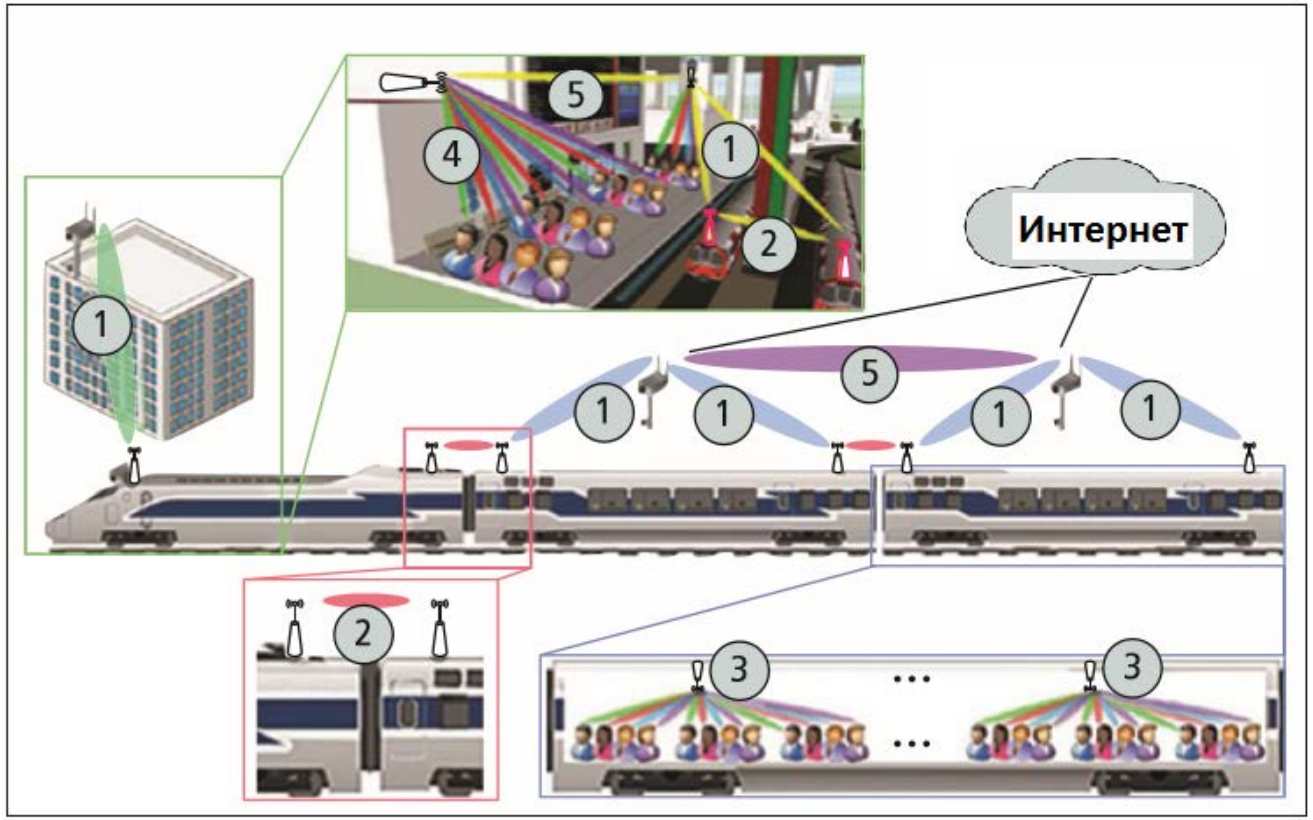
Future Railway Mobile Communication System



On the high-speed rail:
5G network antennas will have to be installed every 400 m



Five scenarios of communication on future railways



Five communication scenarios: (1) train - infrastructure, (2) between cars, (3) inside the car, (4) inside the station, (5) infrastructure - infrastructure.

7.Conclusion: On 5G implementation network cost

There is a significant shortage of 5G-networks: the cost of operators to implement the 5G technology using frequencies above 24 GHz will be prohibitively high.

Example: 5g networks in the New York metropolitan area - taking into account the contours of houses and terrain.
Now in New York there are 1251 base stations, for confident coverage of 5G network will need to add another 635 639 stations, i.e. increase their number by more than 500 times.

The creation of such an infrastructure is unlikely to make economic sense for operators

Acknowledgment

We would like to thank the staff from
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Thanks!

Questions?