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DELIVERABLE D [3.3]

[IP Emulator and scenarios definition]

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[1] PU: Public; CO: Confidential, only for members of the consortium (including Commission Services)

[2] https://projects.shift2rail.org/s2r_matrixtd.aspx

Authors Table

Name	Affiliation	Contribution
Alessandro Vizzarri	Radiolabs (RDL)	Main contributor
Francesco Vatalaro	University of Rome Tor Vergata	Main contributor
Romeo Giuliano	Università degli Studi Guglielmo Marconi (USGM)	Support to contributors
Franco Mazzenga	Radiolabs (RDL)	Support to contributors

The document history table provides a summary of all the changes in reverse chronological order (latest version first).

Document history

Date	Name	Affiliation	Position/Project Role	Action/ Short Description
31 Jul. 2021	Alessandro Vizzarri	Radiolabs (RDL)	Technical Manager/WP leader	Description of the emulator implementation
6 Nov. 2021	Alessandro Vizzarri	Radiolabs (RDL)	Technical Manager/WP leader	The updated document includes all the revisions provided by PO

Table of Contents

Executive Summary

The Task 3.3 of the AB4Rail project is dedicated to the development of the AB4Rail emulator to be used in the next Task 3.4. In this Deliverable D3.3 we details the features of the AB4Rail emulator to be used for transport/application protocol assessment to be carried out in the next Task 3.4 in the WP3 of the AB4Rail project.
The main aims of the emulator are:

a. to reproduce the behavior of the IP-link connecting the on-board and the network side communicating rail applications at IP level. To this purpose the scheme of the emulator accounts for the tunneling feature of the ACS-GW operations. Moreover, it includes important physical parameters (e.g., link delays, capacity and maximum packet size that can be transmitted in a link). The document D3.3 analyzes possible models for generating the impairments and proposes a procedure for taking into account the possible time variability of the wireless channels due to the train mobility.
b. to analyze the implementation of a traffic source/destination with flexible protocol stack allowing to change the transport and the application protocols so to test the different options; to this purpose we have selected some software technologies such as the python scapy library that are available inside the open-source software community.

This deliverable also describes the main features of the software library developed in AB4Rail project to implement the IP-link emulator. The library allows to set the Linux OS lightweight virtual machines to emulate routers, switches, links between two network elements and to emulate the main features of the on-board and the network ACS gateways.
Examples of scripts using the AB4Rail emulator library are provided to illustrate the methodology and procedures used to setup and emulate the desired IP link and, more in general, a network of IP link including tunnels. In this deliverable it is also reported the configuration flowchart and the formats of the configuration files for the control of the emulator and to instantiate elements through the emulator for evaluating the different scenarios in the next Task 3.4.
To prove the effectiveness of the proposed emulator, some preliminary performance results have been provided. Tests considered the transmission of ping ICMP packets between two virtual machines: the first emulating some functionalities of the on-board gateway and the second the application server. Results are reported in terms of the Complementary Cumulative Distribution Function of the Round Trip Time (RTT) packet.