

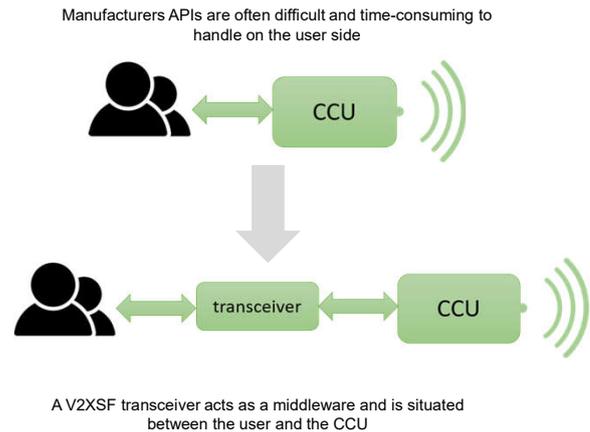
# DLR V2X Software Framework: A CCU-agnostic solution for transceiving V2X messages

## An easy-to-use CCU API for V2X developers

### Motivation

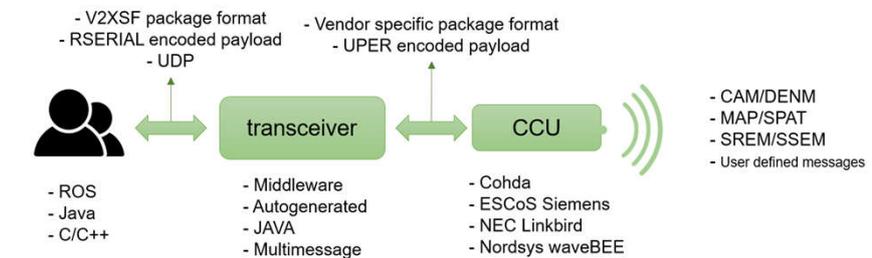
The employment of Intelligent Transportation Systems stations for sending and receiving V2X messages in research projects can become an inconvenient task, even more if hardware of different manufacturers is used. The APIs that manufacturers offer for their hardware are often difficult to handle on the user side. Furthermore, the creation and definition of experimental V2X message types or the extension of existing messages can be time-consuming, especially if a team of developers use different

programming languages or frameworks. The DLR V2X Software Framework aims at solving the named problems by providing an easy-to-use API for V2X end users. The V2X-SF is first and foremost meant to be used in research projects for integrating existing V2X messages and for developing and testing of expanded or new V2X messages and not meant to be used in final products.



### Approach

From an operational viewpoint, the very final output of the framework are programmatically generated applications, so called transceivers, and tools for interacting with them (the so-called V2XSF clients). Transceivers shall hide a part of the complexity of composing, sending and receiving (transceiving) V2X messages, so the user does not need to be an expert in that area. The communication between clients and transceivers happens via UDP channel. They exchange byte streams containing structured data that represents V2X messages encoded using a simple set of rules defined for the V2XSF (RSERIAL).



Transceivers translate RSERIAL messages into UPER messages (encoding rules for V2X) and vice versa, log incoming and outgoing messages, forward data to a backend administration system and create random messages for testing purposes,

among other extra features. Several transceivers can run and interact simultaneously on the same device since they follow the design and functional philosophy of microservices.

### Outlook

At the DLR, the framework is intensely used in research projects for the creation of different V2X applications (mostly ROS and Java), which solve complex use cases with relatively little effort. If an ASN.1 file of a specific V2X message is available, the respective transceivers and user APIs can be auto-generated and included in applications. UPER compilers are expensive pieces of software and the DLR uses the proprietary ASN1C ASN.1 Compiler provided by Objective Systems, Inc. Using a V2XSF transceiver as middleware between a CCU and a user's application this issue can be ignored since the RSERIAL encoding rules can be fastly

	CCU API	DLR V2X Framework
API	Vendor specific	Same for all vendors
New features	Rigid	Flexible
Learning curve	Flat	Steep
PER compiler needed	Yes	No
Data transmission	Faster	Slower
Best for	Final products	Research

implemented in different applications for enabling V2X programming languages. Translators for ROS, JAVA and C/C++ are already implemented and can be embedded in clients connectivity.