When electronic control units (ECUs) are tested, realistically simulating communication is essential. The new dSPACE Bus Manager gives users one central tool for configuring the bus signals for various simulation platforms.

Bus systems are the aorta of ECU networks: In modern vehicles, up to 100 ECUs exchange over 10,000 bus signals. This communication has to be simulated and tested during the entire ECU development process so that it also works reliably in critical situations. With its Bus Manager, dSPACE provides a central implementation tool for all bus applications – from function development, to virtual validation, to comprehensive hardware-in-the-loop (HIL) tests.
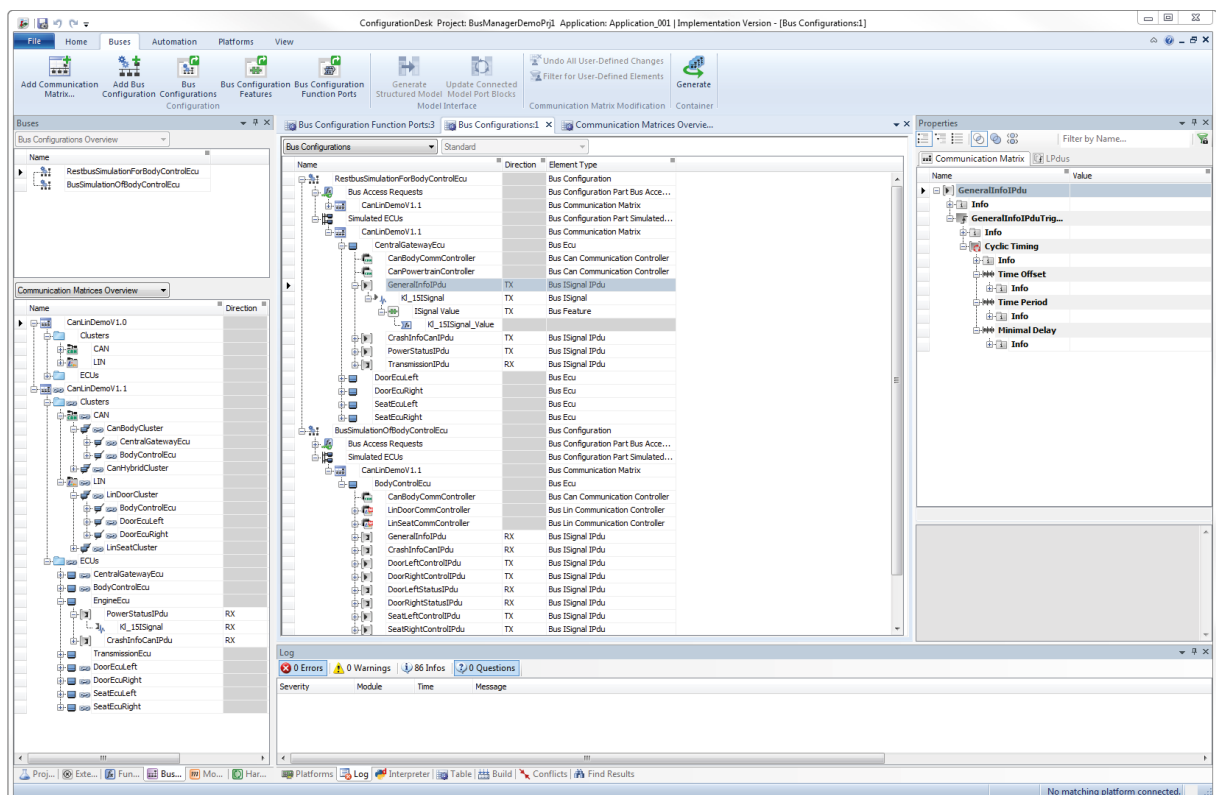
Bus Simulation for All

Be it virtual ECUs (V-ECUs), real ECU prototypes, or simulated ECUs in restbus simulation, the Bus Manager can be used in all of these cases to configure the bus communication and the data transmission to the test system. It supports the various validation scenarios of PC-based simulation with VEOS® and of HIL simulation with SCALEXIO® – seamlessly throughout the entire development process. This way, the best simulation type is used in each case.

Central Configuration Software

The Bus Manager provides several ways to select the parts to be simulated. For example, all signals needed for bus simulation can be grouped either by communication cluster or by the related ECU. This increases efficiency when users handle configurations with multiple, and even different, buses. The Bus Manager makes it possible to reuse such configurations for various simulation systems. Its current version supports the CAN, CAN FD and LIN protocols.
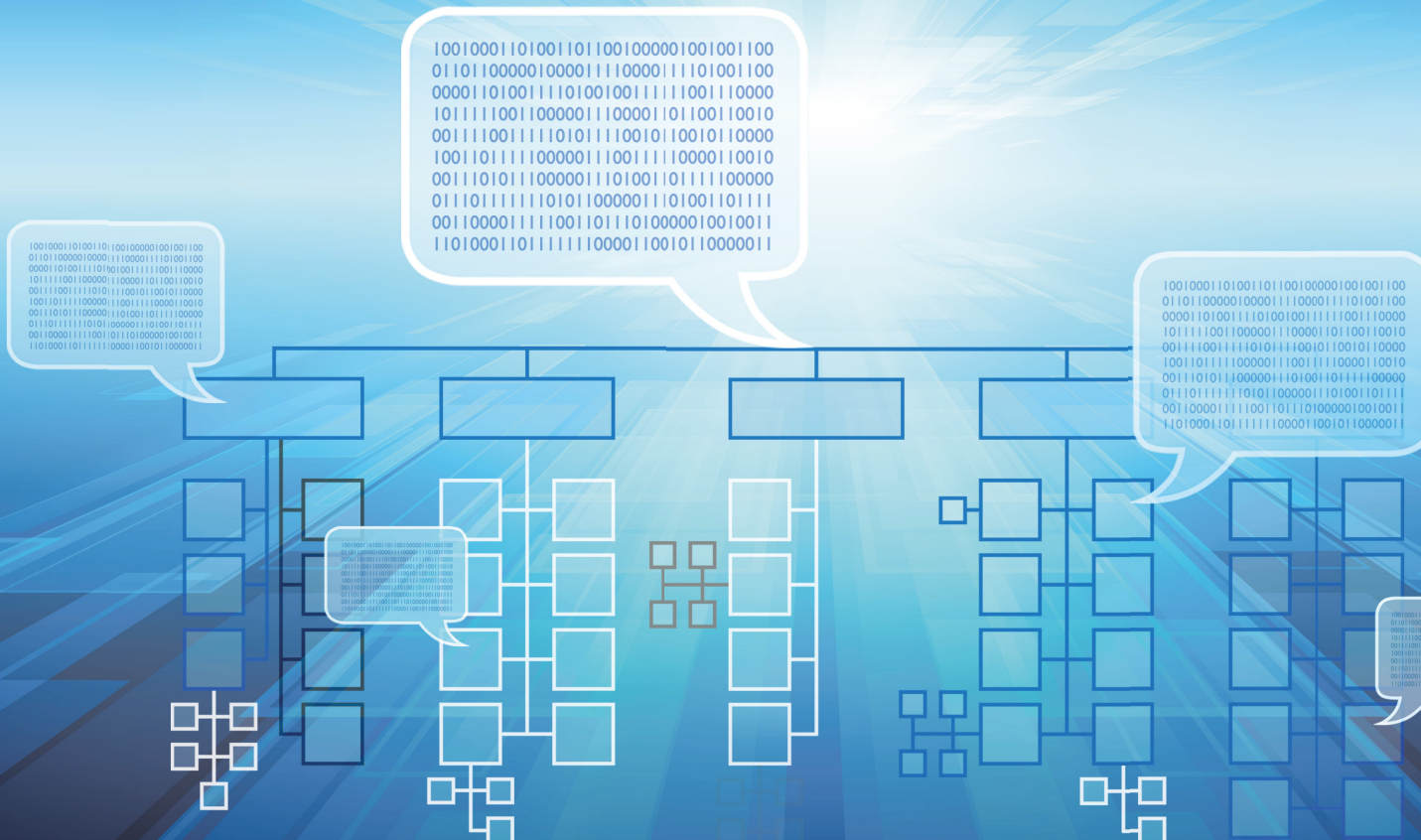
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Figure 1: The Bus Manager provides convenient graphical configuration for LIN, CAN, and CAN FD bus simulation.

Configuring bus systems
and networks centrally
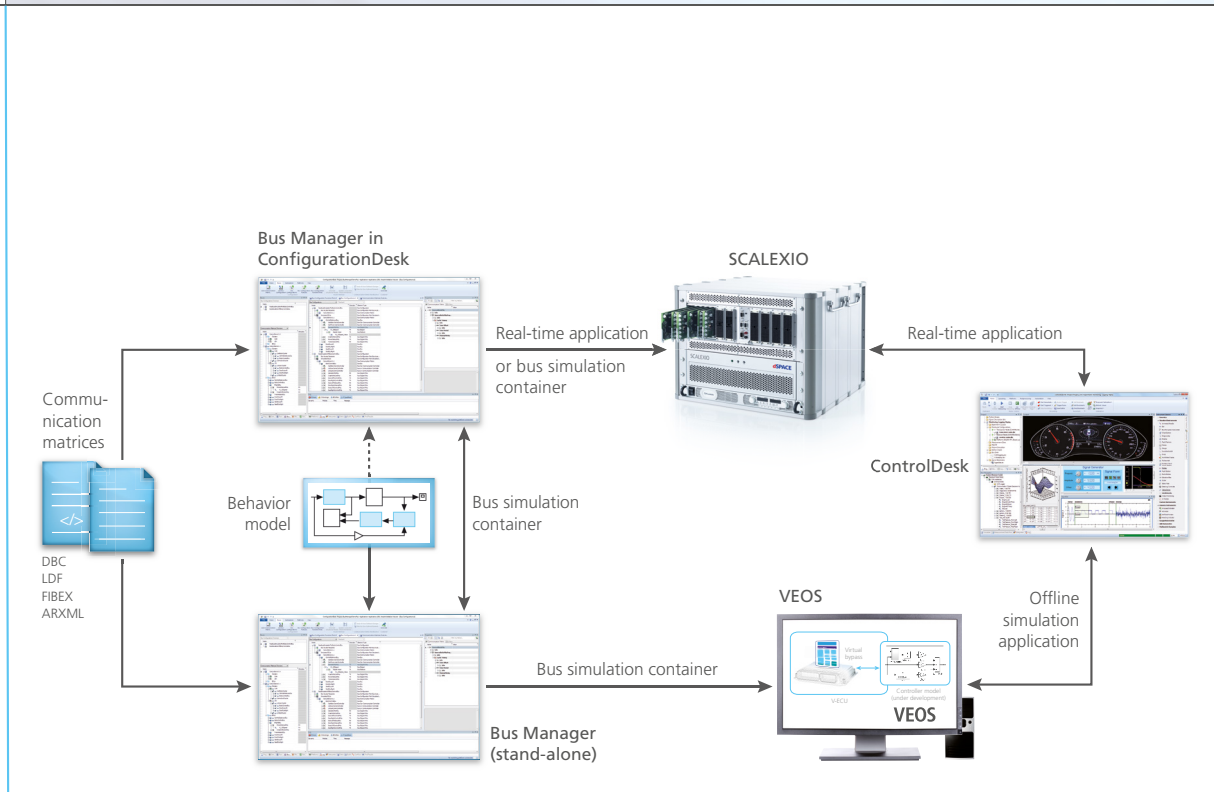
Communication
Is Key

Figure 2: The configuration files generated by the Bus Manager can be used for and exchanged with various simulation platforms.

Other protocols, such as FlexRay and Ethernet, will be supported by future versions. Because only one tool is used to specify all the settings and configurations in all development phases and for all protocols, it is not necessary to familiarize with new tools in each test phase. This eliminates potential error sources.

Configuring Communication with the Bus Manager
Each configuration starts with a communication matrix from which all relevant information is extracted automatically. The Bus Manager supports all major file formats for communication, such as DBC, LDF, FIBEX, and ARXML.
Users take the necessary elements from one or more communication matrices and create their communication configuration. They can switch between different views in the Bus Manager to always have the best possible overview during a variety of tasks, for example, of all available configurations and model interfaces. The final configuration can then be exported as a bus simulation container (BSC) and transferred to the target platform. Using the BSC format makes it much easier to reuse bus configurations in future simulation scenarios so the same configuration is available throughout the entire development process. In addition to Simulink models, existing simulation models can also be integrated in the BSC. The Bus Manager also allows for static restbus simulation without Simulink models, so users can perform simple tests immediately. For simulation with VEOS, users can work with the Bus Manager either as a stand-alone version or as a ConfigurationDesk component. During HIL simulation with dSPACE SCALEXIO, the Bus Manager is always a component of the implementation software ConfigurationDesk. Users therefore need only one software product to centrally configure all bus and network protocols.

Seamlessly from Virtual Validation...
Bus support adds important test features for PC-based simulation with VEOS. Now, the communica-
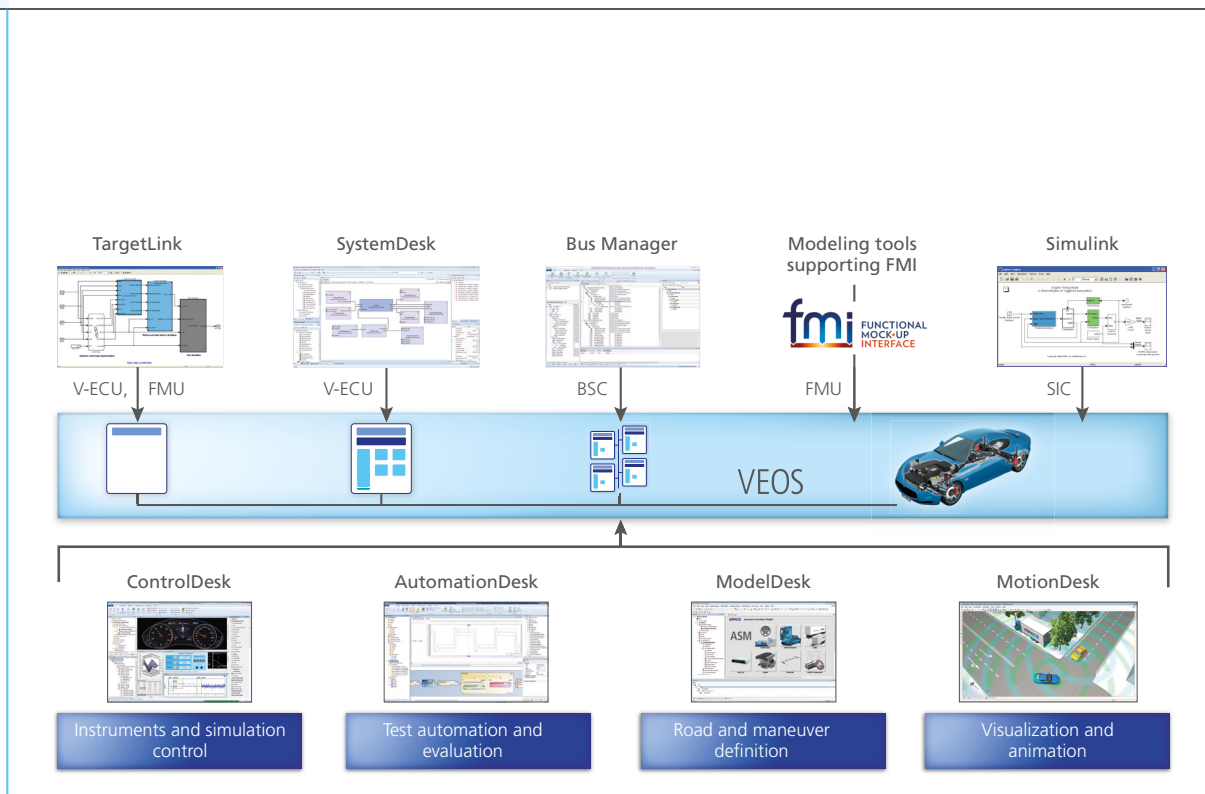
Figure 3: Together with bus communication, VEOS lets users perform realistic simulations for initial function tests on the PC.

tion outside of V-ECUs can also be simulated, tested, and visualized. With VEOS, users can import model parts from various sources and connect them (figure 3). Bus configurations created for VEOS can be reused later in HIL simulation, which ensures consistency throughout the entire development process.
At the same time, function testers using VEOS benefit from existing test configurations for HIL simulations, which they can use as their starting point.

... to HIL Simulation

The great advantage of the Bus Manager and BSCs for HIL simulation is that they can be used for several project variants. BSCs contain both the bus configuration and model parts, so the bus signals can be mapped to the model signals, for example. The interfaces to the plant model remain the same when a BSC is used for a different variant. This means that if a project changes, it is easy to replace the bus parts. This also makes it easier to reuse bus configurations in various projects. If necessary, parameters and prop-

erties of the simulated elements can be changed during a running simulation – with both VEOS and SCALEXIO. For example, users can view, analyze, and modify signal values in the experiment software ControlDesk® during a running simulation. If a simulation requires signals whose values change dynamically during run time, behavior models from tools such as MATLAB®/Simulink® can be used. ∎

Bus Simulation Container (BSC)

A bus simulation container (BSC) is a data format for exchanging bus configurations. It contains not only the data needed for the bus configuration, but also a mapping or scaling model in the form of a Simulink implementation container (SIC). The SIC combines all MATLAB/Simulink functions required for bus communication. It also contains data for the experiment software ControlDesk.
The standardized interfaces of the BSC simplify the exchange of bus configurations between different application areas and projects, thereby making it easier to reuse the complex bus parts.