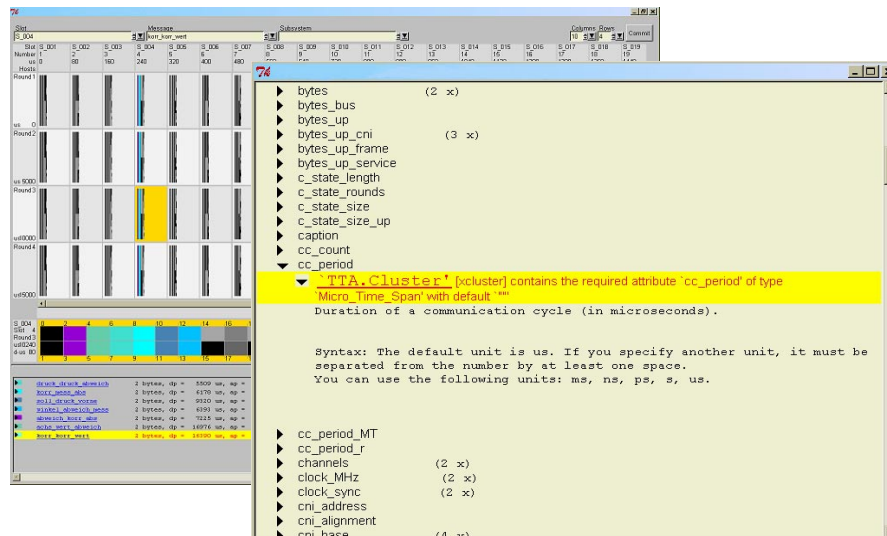


## Automatic Scheduling of Complex FlexRay Systems



## TTXPlan – A High-Level FlexRay Design and Scheduling Tool

### Cluster Design and Scheduling for Distributed Automotive Systems

TTXPlan is part of TTTech Automotive's software development suite for FlexRay™ and enables the design and scheduling of distributed automotive systems. It offers a powerful development environment for highly deterministic networks. TTXPlan is designed to fully exploit the advantages of the time-triggered systems in the vehicle. It supplies an innovative two-level design framework, which supports the seamless integration of electronic subsystems and the network design exchange and workflow between OEMs and different suppliers. The tool takes communication requirements as input, performs automatic mapping of signals to FlexRay frames, and generates complete communication schedules automatically. Alternatively, manual and automatic scheduling methods can be combined and TTXPlan's independently checks the created schedules in order to ensure correctness and consistency with the specification at all levels.

### Precise Cluster Specification with Two-Level Design Approach

TTXPlan supports development processes based on the two-level design approach at the cluster level, where the OEM designs the physical cluster layout, the subsystems, and the interfaces between the subsystems. Those precisely specified interfaces ease integration, enhance quality and reusability of the developed products and therefore translate directly into significant business benefits for all parties involved. TTXPlan can be completely controlled via a scripting interface. It supports standard FIBEX formats as well as customized input/output formats, thus enabling smooth integration with existing development processes. At the node level (in TTXBuild), the subsystems are designed and implemented on the basis of the precise subsystem interactions that are specified in the cluster design. TTXPlan generates precise interface specifications; this supports the two-level design approach and the resulting reduction of development cost and time-to-market for distributed, time-triggered, hard real-time systems.

### Composability for Reduced Test and Integration Cost

TTXPlan supports the development of composable distributed systems, which can consist of multiple subsystems per ECU. Subsystems can be developed independently, and later integration proceeds without side effects. This can result in significant cost reductions and time reductions. Node implementations can be tested locally against a simulation of the final cluster. The time-triggered nature of the network allows very precise simulations because of the strict cluster specification that pins each signal to a precisely defined time slot.

## Tool-Based Validation of Parameter Sets in FlexRay Systems

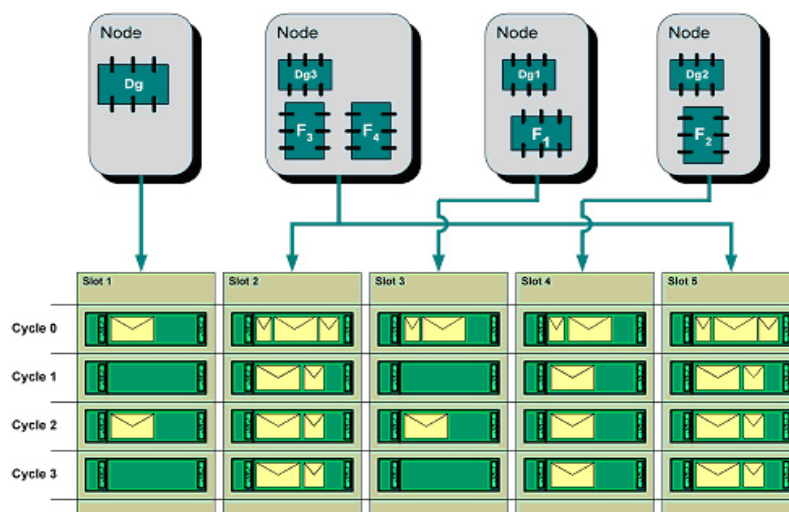
<sup>TTX</sup>Plan enables consistency checking of the FlexRay communication specification. The tool validates the generated FlexRay schedule against specifications provided by the user, as well as implicit requirements from the FlexRay specification. <sup>TTX</sup>Plan facilitates validity checking of the communication specification early in the development process.

## Fully Automatic Signal Mapping

In <sup>TTX</sup>Plan, the mapping of signals to FlexRay frames is fully automated. If all signals are scheduled without conflicts with one or more signal specifications, the system specification is complete. The information is stored in a database and can be exported in FIBEX format.

## Incremental and Mixed Manual and Automatic Scheduling

Incremental scheduling enables the developer to schedule a cluster and define spare areas in frames, which can be used for future upgrades. Additional signals can be added to these spare areas in frames without changing the previously existing parts of the schedule. <sup>TTX</sup>Plan combines the advantages of both manual and automatic scheduling to further shorten the development cycle and add flexibility to the development process.



The figure above shows a picture of a FlexRay cluster specification with some spare areas in the schedule. Incremental scheduling will utilize these spare areas without changing any of the previously defined allocations. The resulting combined schedule is fully compatible to the original one.

For further information, including price and availability, contact [products@tttech-automotive.com](mailto:products@tttech-automotive.com)

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