



ETHERNET NETWORK SERVICES BASED ON NEW SWITCHES AND ROUTERS

WHITEPAPER



SELECTRON

Future-Proof Ethernet Networks Based on New Selectron Routers and Managed Switches



Based on its experience, professional team and new switches and routers, Selectron enables its valued customers with value-adding networking services

Up until recently, train vehicles have electronically been managed based on fieldbus communication such as CAN, MVB, etc. New operational concepts like CBTC, ATO or ETCS, as well as the passengers need to have additional information (PIS, Passenger Information System), lead to the demand for more performance, bandwidth and flexibility in terms of underlying communication infrastructure. Traditional pyramid systems in which end devices communicate with nodes that are being controlled with a central PLC become more and more outdated, as all the devices start communicating directly together. Out of this follows that recent trends show a clear and transparent direction to design onboard networks based on Ethernet technology. What, at first glance, appears to be a simple continuation on industrial development, leads to significant challenges in terms of understanding the network.

Traditional fieldbus systems are designed as an easy and understandable point-to-point communication. In these types of systems, the built-in components (i.e., the underlying hardware with the respective software running on it) are essential. In reality, this means that you can deploy two independent devices and link these two elements based on a CAN or MVB bus. This is the so-called “device-centric” approach, in which the network is an outcome of two or more linked elements. This changes drastically when talking about an Ethernet network. Of course, there are various types of networks, nevertheless they have one thing in common: the hierarchy automatically needs to be inverted. Instead of starting with a user (CPU1) and linking it with another user (CPU2), in a network environment you first have to design the network and then link the users to this very network. It becomes evident that the network is an entity of its own.



Why is this difference important? In the “net-centric” approach the focus must no longer be on the individual component level, but on the system level being the network. The network is not only the sum of its devices, but an autonomous system that provides services to its users; that is, the attached devices. If the network is not designed correctly – taking into consideration all the potential device behaviors – the reliability and performance of the network as well as the connected devices may be jeopardized.

Selectron has made significant investments and has sustainably built-up the expertise to offer a wide range of networking products and services to its customers. Together with your experts, we help design the right engineering concept for you and put your needs at the forefront. We have an international team of recognized networking experts, each of whom have many years of experience in his and her field. Customers of Selectron may use this expertise when designing a network, during the commissioning phase and also when problems may occur. Together with our cybersecurity experts, we form a team ensuring you have the most modern and best-secured Ethernet network inside your train vehicle.

Technically, we underpin this service expertise with our new networking products. Our new Ethernet Consist Switch (ECS) comprises the latest hardware technology and is fully cyber secure. Its built-in security by design is certified according to Security Level 2 (IEC 62443) and, of course, fulfills all requirements according to EN 50155. Its purpose is the implementation of network topologies inside the vehicle.

For this, it contains (among other features):

- Up to 16 Fast Ethernet ports, or
- 6 Gigabit Ethernet ports + 10 Fast Ethernet ports
- IPv4 protocol supported
- 2 hardware bypasses for maximum reliability
- Spanning tree (STP 802.1D) and Rapid Spanning Tree (RSTP 802.1w)
- Link Aggregation Protocol (LACP 802.3ad)
- Up to 4096 802.1Q VLANs and Inter-VLAN routing
- Multicast Group Membership IGMP
- Multicast routing
- 8 output hardware queues for each port
- Strict priority or weighted round-robin (WRR) scheduler
- Inbound/outbound traffic rate limiting/shaping

A true 2-in-1 product is our Train Backbone Switch (TBS). It is both an IEC 61375-Standard Train Backbone Node and an Ethernet Consist Switch. This proposal allows customers to save onboard space and, at the same time, improve network robustness to maintain compliance with standards. It is, of course, also very cost effective, you just

have to invest in one hardware to get the effect of two products. It is equipped with double-switched backbone lines protected by bypass relays.

For train backbone activities and 12 Ethernet ports at consist level with an additional bypass relay to enable a more reliable consist topology implementation. The IEC 61375-2-5 train inauguration procedure is fully supported, and it provides an ETBN control interface for TRDP devices as per IEC 61375 guidelines. On the backbone side, 4 Fast Ethernet or Gigabit ports are available with hardware bypass for maximum reliability. On the consist side, 8 Fast Ethernet ports can be equipped with PoE functionalities, 2 ports (Fast Ethernet or Gbit Ethernet) come with a hardware bypass (supporting ring topology implementations with a higher level of robustness). The remaining 2 are Fast Ethernet ports.

Selectron is committed to continuously developing its networking products further into the future. In 2022, we will present a rack version of both products as well as a 28-port version. Our Ethernet-based Threat Detection



Solution (TDS) will in future directly be integrated as a function. Also in 2022, we will start to enable TSN (Time Sensitive Network) functionalities. This will include a deterministic network solution, then also redundant control and data paths with zero-delay switchovers.

Based on Selectron's advanced communication know-how, you can rest assured you're in safe hands

Based on the Selectron Advanced Network Designer (SAND), designing and configuration of the network was never so simple.

Selectron Advanced Networking Designer (SAND) is an advanced graphic application for multiplatforms helping customers to design and operate in an organic and coherent way its Ethernet Train Consist Network using networking devices manufactured by Selectron Systems AG.

Network design contains all the activities to plan and structure the network infrastructure, influencing the overall system performance, reliability and security. This process is fully supported by SAND based on a user-friendly interface. The entire network diagram, all the devices (standard or customized devices), the placement, the cabling structure as well as layer 2 and security architecture can be planned in great details. Of course, all elements are closely linked and highly integrated.

To compensate for eventual lack of understanding or experience, SAND contains a broad range of templates that may be used as guidance or starting point for the desired robust topology structure. This prevents failures, minimizes bottlenecks and increases the entire performance.

Devices may be configured individually on device level, or, to maximize reuse and simplify management, in predefined groups of shared

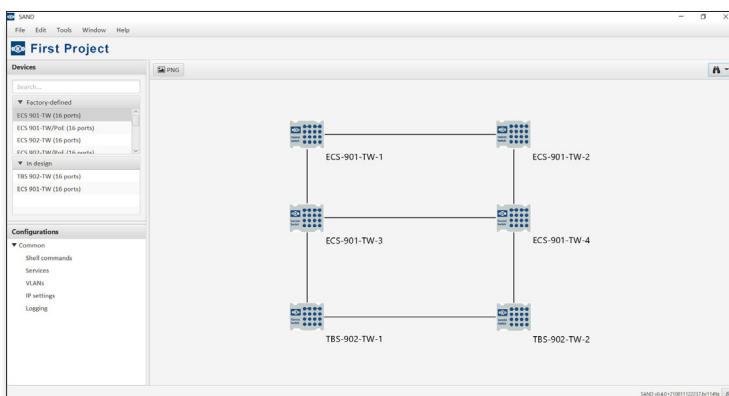
configuration elements. These elements are then applied to the entire group or to network subset.

To minimize operational errors and to ensure data consistency, SAND applies and runs a set of verification rules. All potential errors are documented with a great number of information, guiding the customers on how to fix or optimize the design. SAND can export the networking architecture in several formats in order to store all the information needed and facilitate the production of design documentation.

After the design and verification process, the entire design can automatically be distributed and applied to all the devices without additional manual interaction, simplifying maintenance and network management operations.

SAND is offering a wide set of utilities such as automatic network discovery or verification of the final result in order to identify gaps, inconsistencies and possible criticalities.

Using SAND solution, in case of failure, networking devices can be easily replaced as the software automatically re-configures new hardware elements without the need of experienced staff.



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