Networked Systems in the Cayenne

Communication and Data Transmission



A fully networked system takes care of all electronic data exchange in the Cayenne.

With its move into the Sport Utility Vehicle segment, Porsche simultaneously struck out on a new path in terms of communication and data transmission between electronic control units in a vehicle. This path is embodied in the new optical-based technology (MOST: Media Oriented Systems Transport) which was used in the Cayenne in addition to the more familiar network architectures. Its MOST-based infotainment system makes Porsche one of the first constructors to offer a scalable and modular concept in this area.

The tide of digitalization has brought with it a wealth of data from various sources that must be transmitted and exchanged within a vehicle. Chassis and security systems (automatic transmission, brake system, etc.), comfort electronics (air-conditioning system, ParkAssist, etc.) and infotainment (navigation, radio, telephone, etc.) are reliant on electronic information, indeed they are controlled by this data. Traditional electronic concepts would not be able to cope with the high requirements that the Cayenne demands in this area, so Porsche installed a fully networked system, in which some 40 control units take care of a comprehensive range of tasks. To ensure that the control units can communicate perfectly with one another, suitable transmission technology and a practical system architecture was required. To this end, Porsche decided to break down the complex vehicle electrical system into more manageable subsystems, in which each electrical control unit was classified according to specific aspects. Environmental conditions (installation location), security issues (error protection, real-time), data transmission capacity, operational relevance and the specific electrical properties of the unit were among the criteria applied. On the basis of this classification, the vehicle was divided into electrical units, into the main vehicle segments and vehicle subsegments. These units are linked to one another via special gateway control units and can thus exchange data. The main vehicle segments include the areas of drive, comfort and infotainment. They are equipped with what are called system busses, which were selected in line with the relevant requirements. In addition to these system busses, there are also a number of sub-bus segments which connect the sensors and actuators locally.

Controller Area Network (CAN): Basic networking technology

CAN is used in the Cayenne as the basic technology for the drive and comfort segments. The different requirements in these areas call, inter alia, for different CAN physical layers. The CAN (Class C) used in the drive segment works at a transmission rate of 500 kBit/s and is operated via a high-speed physical layer. It supplies, for example, the automatic transmission or brake systems with the information they require. In the comfort segment the CAN (Class B) works with a transmission rate of 100 kBit/s and controls, e.g. the air-conditioning system or the ParkAssist. Here a lowspeed physical layer is used.

The physical layer chosen depends on the desired transmission rate, the wakeability of the bus system and its error tolerance and error traceability. For example, a wakeable system requires a decentral network management system that allows the system to be woken by defined components in an eventcontrolled manner. In contrast, the drive segment is only activated upon ignition.



Position and arrangement of networks in the Cayenne for the drive, comfort and infotainment segments

High degree of innovation in the infotainment area

In the last few years there has been a major burst of innovation in the infotainment segment. More and more technologies and functions from the area of communications and entertainment are now being incorporated into cars. The infotainment system in the Cayenne already combines established functions - such as navigation, radio, CD and telephone - with new technologies. A uniform operation and display concept allows the driver to use this entire complex system in a safe and convenient manner. The network technology, which in addition to the new functions, also enables a modular and scalable system architecture played a key role in the development of the Cayenne infotainment system. Thus various functions can be flexibly distributed to individual components. The components, in turn, can be added or replaced as required.

In addition to control commands and status information, audio and/or graphic data streams must now be transmitted between system components at high bandwidths. Given all these requirements, MOST technology was the natural choice for the Cayenne's infotainment segment.

MOST technology: High-speed data transmission

The MOST network transmits digital data optically at high speeds via inexpensive polymer monomode optical fibers (POF). These optical fibers are arranged in a ring because of the one-way nature of the transmissions. In addition to its great speed, optical transmission technology offers two further critical advantages: it not only minimizes the disruptive electromagnetic emissions of the network, it simultaneously makes it insensitive to interference from outside.

All data is transmitted point-to-point (component to component) in the multiplex on a single fiber. This information which has been prepared for "single wire transmission" (bit sequences) is encoded in a selfclocking code (biphase mark). It is converted opto-electrically before processing by special MOST hardware (transceiver) contained in every component or electro-optically after processing, as the case may be.

The entire technology is based on a synchronous transmission mechanism, which is specially aligned to the connection and extraction of digital audio data. The data is transmitted at a fixed data rate in real time thus removing the need for a buffer in the receiver. Consequently, the information of any data sinks connected to the network is available in parallel (broadcast) and can be used simultaneously by several applications.

Packet or burst data, for example when sending SMS messages via the telephone, is transmitted via an asynchronous transmission service for which appropriate buffers are provided. The resource distribution of the bus (asynchronous/synchronous) is thus freely scaleable in many areas. In the Cayenne the MOST network is synchronized at a frequency of 44.1 kHz, producing a data transmission rate of 21.2 MBit/s. Apart from the control and monitoring information, the data transmitted is primarily audio (CD, radio), language (navigation, telephone) and graphics data (navigation map).

Following on from the success of the Cayenne launch, this new MOST technology will soon be used in the infotainment systems of the 911 and Boxster series. Porsche is thus one of the first vehicle constructors to offer a consistent, scaleable and modular concept in this area and now thanks to Porsche Engineering this know-how will also be available to customer projects.