CAN FD with no bit-rate switch

If you do not need more data throughput, CAN FD may be also beneficial, when longer payloads are desired. This is sometimes overlooked.

Abhi Aarey: "CAN FD standard is well-rounded and offers advantages in a wide variety of applications." (Photo: Texas Instruments)

Abhi Aarey working with Texas Instruments (TI) discussed on his blog the non-speed-related benefits of CAN FD. Besides the increased data-rate, the improved CAN protocol also provides a longer payload of up to 64 byte. This enables more efficient transport protocols. "You can split large data packets into fewer frames compared to Classical CAN, thereby reducing protocol overhead at the higher layers," explained the blogger. "In addition, implementing a transport layer protocol reduces the effective size of the data payload as well. While this degrades the efficiency of Classical CAN due to its small data size, FD remains largely unaffected." This efficiency improvement is independent of speed. The advantages build up progressively as the payload size increases and peaks at the maximum payload.

The blogger also discussed the improved error handling by means of the CRC field with fixed stuff-bits and the stuff-bit counter: "CAN FD deploys higher-order cyclic redundancy check (CRC) polynomial expressions. The data-length field in a CAN frame contains the payload size information, and helps to choose the appropriate CRC algorithm so that the Hamming distance remains unchanged. CRC17 (28 bit) and CRC21 (33 bit) are used for payloads up to 16 byte or more than 16 byte, respectively." Payloads up to 8 byte use the classic CRC15 (16 bit) algorithm.

"The difference in the number of CRC bits is significant. The analogy of a longer password being harder to crack is very relevant here; it is significantly harder for a random bit pattern to just happen to coincide with a much longer string of CRC bits, thereby improving the robustness and validity of the calculated CRC value," explained Abhi Aarey.

The CAN FD bit stuffing incorporates dynamic stuffing in the arbitration, control, and data field. The CRC field contains fixed stuff-bits and stuff-bit counter. The 3-bit counter codes the dynamic stuff-bits in a Gray code. The count is protected by a parity bit and a fixed stuff-bit. These mechanisms detect all one-bit errors. Additionally, multiple bit-errors are discovered with a higher probability than in the Classical CAN protocol. The blogger summarized: "Far from being a one-dimensional speed upgrade, the new CAN FD standard is well-rounded and offers advantages in a wide variety of applications." On his blog, Abhi Aarey, discusses also other CAN topics: bus-termination, network debugging, improving EMC, 3,3-V transceiver, etc.

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