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Unified Communication Framework (UCF)

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UCF is a unified network protocol and FPGA firmware for high speed serial interfaces employed in Data Acquisition systems. It provides up to 64 different communication channels via a single serial link. One channel is reserved for timing and trigger information whereas the other channels can be used for slow control interfaces and data transmission. All channels are bidirectional and share network bandwidth according to assigned priority. The timing channel distributes messages with fixed and deterministic latency in one direction. From this point of view the protocol implementation is asymmetrical. The precision of the timing channel is defined by the jitter of the recovered clock and is typically in the order of 10-20 ps RMS. The timing channel has highest priority and a slow control interface should use the second highest priority channel in order to avoid long delays due to high traffic on other channels. The framework supports point-to-point connections and star-like 1:n topologies but only for optical networks with passive splitter. It always employs one of the connection parties as a master and the others as slaves. The star-like topology can be used for front-ends with low data rates or pure time distribution systems. In this case the master broadcasts information according to assigned priority whereas the slaves communicate in a time sharing manner to the master. Inside the OSI layer model the UCF can be classified to the layers one to three which includes the physical, the data and the network layer.

The above presented framework can be used in trigger and fast data processes as well as slow data or monitoring processes. It can be applied to every kind of experiment, may it be the neutron lifetime experiment PENeLOPE in Munich, the Belle II experiment at KEK or the COMPASS experiment at CERN. In all these experiments UCF is currently beeing implemented and tested.

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