A Safe Driver Assisted Merge Protocol

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This paper presents a new cooperative driving protocol which assists drivers in merging with other vehicles. Safety and efficiency are two important factors to design the protocol.

At first, the paper presents protocols which contributed on three generations of the merge protocol. The first one is communications channel that provided best effort delivery, it generated the protocol which can recover lost messages and coordinate the processes. The second one is Automatic Repeat Request (ARQ) protocol, it generated the protocol which has separate state machines for merging operation. With the participation of timed token, the Reliable Neighborcast Protocol (RNP) can recover lost messages and guarantees all presented application with same information, which enable the cooperation between vehicles.

Then the paper introduces the driver assist architecture. The main difference between this protocol and original protocol is it is based upon relatively separate modular architecture and drivers will participate in the system. The merge application operates over other applications but not interact directly with the sensor in a vehicle. Coordinate Sensor Readings module is responsible to merge all sensor results. By doing this, we can both simplify the writing process and verification process.

Finally, Extended Finite State Machine (EFSM) is also applied in modeling the merge application. And the paper introduces Probabilistic verification to check if the unacceptable states are included in all possible set of output sequence. By extending the probabilistic search tree, the paper proved that the protocol is safe for general case, and it lead to deadlock in a very rare event.