# A module for the FTT-SE protocol in ns-3

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## EXTENDED ABSTRACT

The Flexible Time Triggered Switched Ethernet (FFT-SE) protocol allows the concurrent transmission of both real-time (i.e., synchronous and asynchronous) traffic and best-effort traffic over Ethernet. Communications within an FTT-SE network are done based on the reservation of fixed duration time slots called Elementary Cycles (ECs). The construction of the ECs and the media access control are managed by the master node. The FTT-SE protocol uses the master/slave paradigm, in which the slave nodes make petitions for transmission to the master node, and the master node grants them access for transmission according to the scheduling algorithm chosen by the master node (e.g., Rate Monotonic, Earliest Deadline First, etc.).

In current automotive applications, tens of electronic control units are interconnected by different network technologies. But such technologies only provide low transmission and processing power. In the future, applications will require larger bandwidth to comply with new functionalities in the car as infotainment and driver-assistance applications. Those applications will require a network that conciliates the transition of best-effort traffic and real-time traffic. Other Real-Time Ethernet (RTE) protocols have been proposed for vehicular networks (e.g. TTEthernet, AV-Bridges, etc.), but they are not flexible enough (e.g. TTEthernet does not support the transmission of asynchronous traffic). The FTT-SE protocol provides communications with real-time guarantees, which is an extremely important characteristic when designing complex real-time distributed systems [1]. Figure 1 shows an example of automotive application in which transmissions are based on the FTT-SE Protocol.

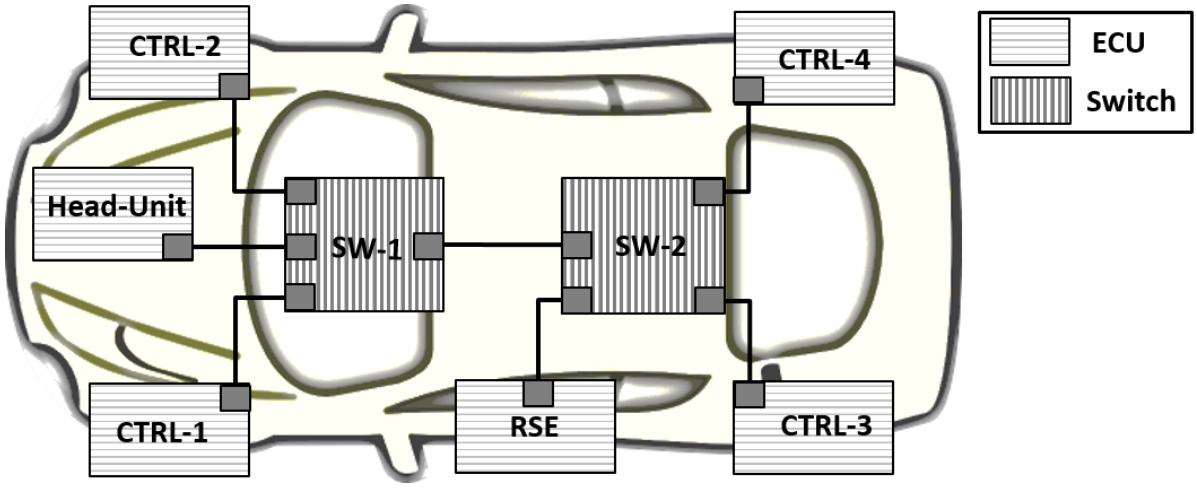


**Figure 1 Automotive application based on a FTT-SE network**


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In this demo, we present the module for the implementation of the FTT-SE protocol in ns-3. The current implementation of the FTT-SE module is done as an application layer of ns-3. Currently, the module allows for concurrent synchronous, asynchronous and best-effort communications. The ECs are divided into sub-windows; those sub-windows are dedicated to the transmission of the different types of traffic. The types of traffic in the FTT-SE protocol are: (i) synchronous traffic (with priority 1, the highest); and (ii) asynchronous traffic, the asynchronous traffic is has three different types of traffic: (a) hard

real-time (with priority 2); (b) soft real-time (with priority 3); and (c) best-effort (with priority 4, the lowest). All types of traffics can be transmitted in a single EC which is built by the master node. Furthermore, the percentage of the EC dedicated to the synchronous or asynchronous transmission is tunable and can be decided based on the application needs.

The proposed demo on FTT-SE ns-3 module plans to provide: simulated communication of real-time data over Ethernet that can be visualized through Netanim; Wireshark of the traced packets; statistics on delay/comparison with vanilla Ethernet approach; overview of the code, which will be delivered for the NS-3 review by the end of the summer. By the end of April 2015, the current state of the code will be available on:

https://bitbucket.org/micheleISEP/fttse-ns3

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