Secured Intersection Data Acquisition for Connected Vehicles Operations

The project aims to extract Signal Phase and Timing (SPaT) data from a Traffic Signal Controller (TSC) cabinet to the edge and process it to provide accurate timing information to the driver's handheld device. The core of this economical solution is a Data-Diode that houses two microcontrollers linked together through a simplex communication connection. The Data-Diode obtains SPaT data from a TSC cabinet which is processed to provide precise timing information to the driver's handheld device. One of the microcontrollers connects to the TSC's Ethernet port and obtains SPaT data via a Simple Network Management Protocol (SNMP) interface while being isolated from the rest of the world. The obtained data is Cyclic Redundancy Check (CRC) encoded then transmitted to the second microcontroller via a unidirectional UART interface. The second microcontroller interfaces with a 4G Cell Modem to transmit the received data to NATS open-source messaging system after embedding a unique ID for the TSC. The data obtained from multiple such TSC-Diode systems is first categorized into different subjects using their unique IDs. The categorized data is then routed to different channels through NATS and stored in a Postgres database. A backend script receives GPS coordinates of the user's handheld device, identifies the nearest Traffic intersection, and renders the light status and light switching time of the corresponding TSC vehicle's lane from the database to a web app on the user's phone.