



# Technology Offer

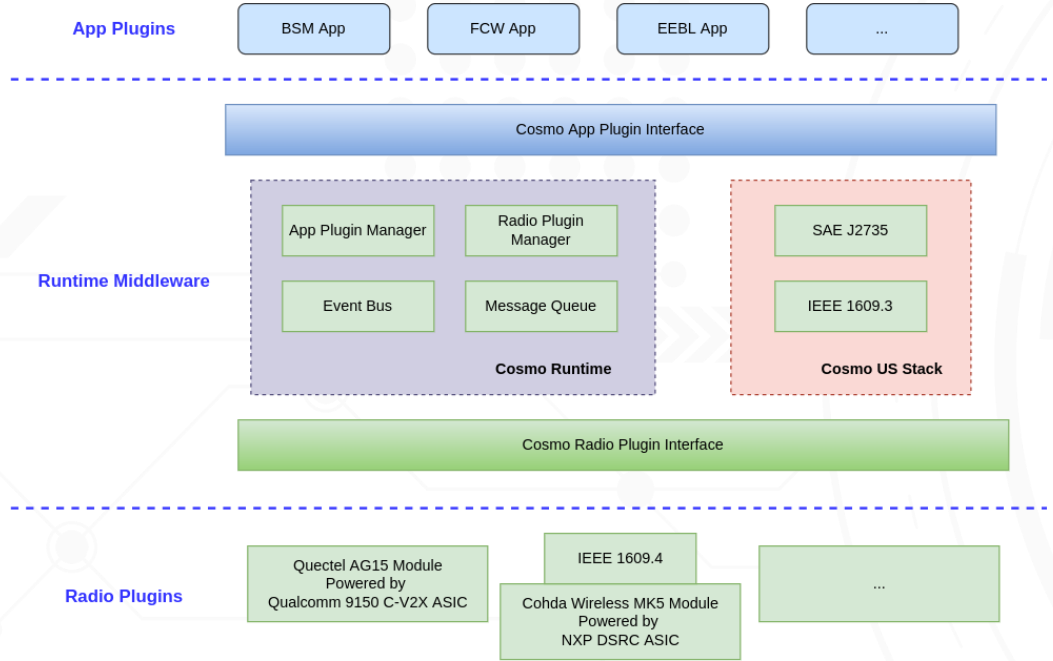
## Intelligent Transportation System Runtime Middleware

### Technology Overview

Conventionally, V2X use cases are developed with the SDK provided by hardware vendors, as a result, V2X use cases are deeply coupled with the hardware modules. At the same time, conventional approaches put all use case logics in a big executable, the big executable also served as the resource manager for the use cases, which make the approach hard to scale up and down.

This technology offer is an ITS Runtime Middleware that tackles the above mentioned two drawbacks of conventional approaches with two plugin engines. With this middleware,

- system can be easily scaled up and down by incorporating independent use cases as plugins
- hardware from different vendors or even with different technologies can be supported automatically as plugins
- communication-standard stacks are facilitated in the middleware



### Technology Features / Specifications

- This ITS Runtime Middleware has the following major functional blocks:
- ✓ Application plugin engine that loads and unloads V2X applications
  - ✓ Event bus that facilitates a flexible pub/sub based message broker to enable communications among applications and runtime
  - ✓ Message Queue that enables a producer/consumer pattern between applications and lower layer blocks
  - ✓ Communication stacks implemented for SAE J2735, IEEE 1609.3 and IEEE 1609.4
  - ✓ Radio plugin engine that interfaces with different V2X hardware modules, by default it comes with two working hardware modules plug-ins:
    - for Quectel AG15 Module based on Qualcomm 9150 C-V2X ASIC
    - for Cohda Wireless MK5 Module based on NXP DSRC ASIC

### Potential Applications

- ✓ V2X On Board Unit (OBU)
- ✓ V2X Road Side Unit (RSU)
- ✓ V2X Subsystem for Carputer OS

### Benefits

- ✓ V2X application development and deployment are decoupled from specific V2X hardware
- ✓ V2X application suites can be easily scaled up and down for a V2X box
- ✓ V2X applications support both DSRC and C-V2X technologies automatically
- ✓ Standard compliance is facilitated by the middleware
- ✓ Extensions for new hardware support will be provided by the middleware

Please contact Prof. Guan Yong Liang (NTU) for further discussions on this technology.