Migrating Automotive ECU to Multi-Core and Dynamic Software Stack Scheduling

Product

Network and Security ECU

Business

Automotive Network Supplier

Product Overview

The mixing of wired and wireless protocols, increased bandwidth requirements of multimedia applications and driver assistance systems, firewall, the sheer volume of data types, and number of channels of communication data is creating the demand for extremely high performance compute platform to support the automotive gateways. New network processing ECUs must operate at significantly higher frequency, support multiple software stacks, provide dynamic response behavior and support new security features. Gateways must support network topologies from 1Mbps to 1Gbps.

Team background

Systems Engineers, Software Engineers

Challenges

- Develop Gateway ECU to support 32 channels of CAN, CAN-FD and Ethernet with packing, unpacking, intrusion detection, and power modes features.
- Determine compute, scheduling, and storage hardware to meet cost and timing deadline.
- Eliminate bottlenecks, high buffer occupancy and low throughput sequences.
- Tune the software architecture to execute within the compute budget.

Results

- Defined hardware, software, buffer and scheduler to meet latency and throughput
- Selected a commercial processor with quad-core ARM and 64GB of DDR3 DRAM
- Created multiple software scheduling algorithms to support different vehicle package
- Model development was three months. Reused model to configure each customer requirement.

Results

- VisualSim System Resource, Script, Power, Traffic Reader, TSN and Gateway libraries
- Used traces from existing vehicle and created synthetic traces to stimulate the VisualSim model.
- Model forwarding, frame storage, packing/unpacking, dispatcher, interrupt and scheduler
- Statistics are CPU utilization, Buffer usage, Throughput per CAN ID and end-to-end latency
- Optimized for power by introducing power modes and wake-up states.