In-Vehicle Networking with NDN

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NAMED DATA NETWORKING

Evolving In-vehicle Networks

- Vehicle networks are rapidly evolving
  - Few Kbps -> 100s Mbps
  - Sensors, cameras LiDARs
- Several technologies
  - LIN, LVDS, CAN, CAN-FD, FlexRay, Ethernet
  - Mix of networks in near future, converge in long term
  - IP/Automotive Ethernet is actively being considered as the next networking technology
- Drivers: cost, weight, compatibility, bandwidth, real-time, safety, security
- Applications: In-vehicle entertainment, advanced driver assistance (ADAS), Autonomy, V2X

https://blogs.keysight.com/
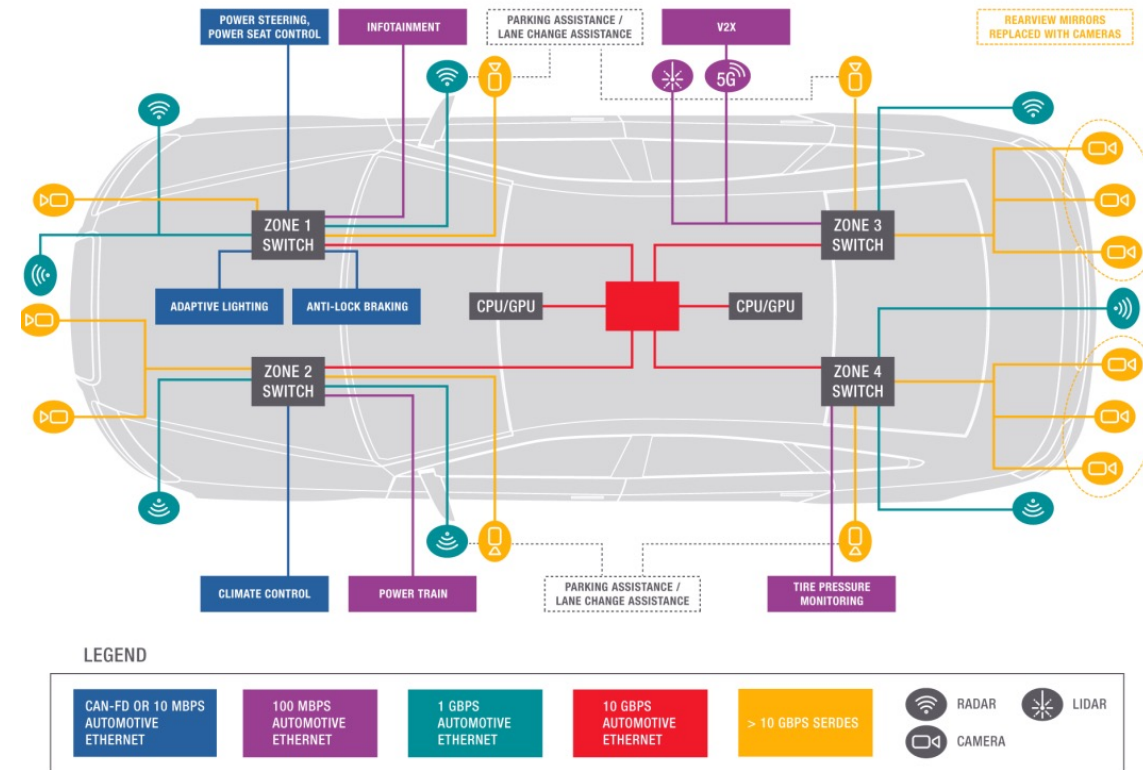
A Case of NDN for In-Car Networking
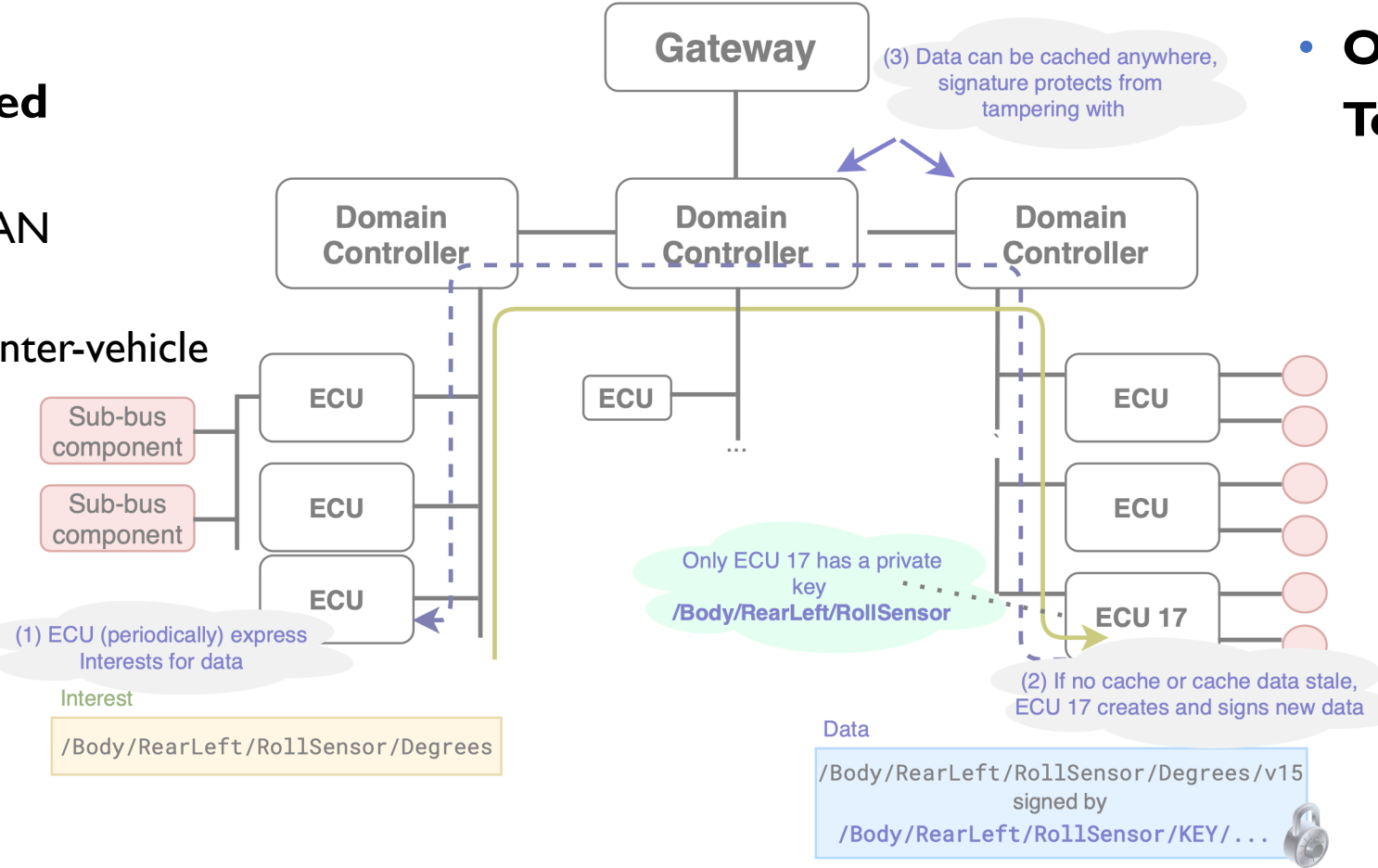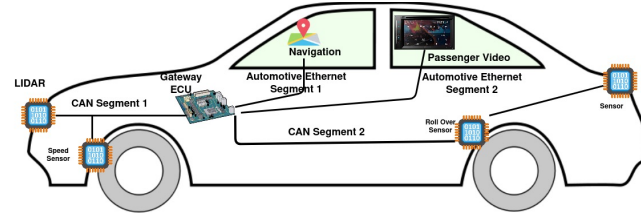
- **Naming**
  - Aligns with Vehicle Signal Specification Data Model (W3C)
- **Stateful name-based forwarding**
  - Map to existing CAN structure
  - Support complex inter-vehicle relations
- **Data security**
  - True end-to-end
  - Flexible privilege separation

- **Caching**
- **Multicast**
- **Our Automotive Testbed**
  - Raspberry Pis with Ethernet and CAN interfaces
  - Running NDN
  - Actual CAN datasets
  - Experiments with NDN and IP to evaluate forwarding, security, etc.

LIDAR • Gateway ECU • Navigation • Passenger Video • Sensor • CAN Segment 1 • Automotive Ethernet Segment 1 • Automotive Ethernet Segment 2 • CAN Segment 2 • Speed Sensor • Roll Over Sensor

Gateway

(3) Data can be cached anywhere, signature protects from tampering with

Domain Controller — Domain Controller — Domain Controller

ECU • Sub-bus component • ECU • ECU • ECU • ECU • ECU 17

Only ECU 17 has a private key
/Body/RearLeft/RollSensor

(1) ECU (periodically) express Interests for data

(2) If no cache or cache data stale, ECU 17 creates and signs new data

Interest
/Body/RearLeft/RollSensor/Degrees

Data
/Body/RearLeft/RollSensor/Degrees/v15
signed by
/Body/RearLeft/RollSensor/KEY/...