

An Intent-Based Management Framework for Software-Defined Vehicles

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Abstract—Software-Defined Vehicle (SDV) is a software-driven vehicle platform for autonomous vehicles in Intelligent Transportation Systems (ITS). An SDV includes an automotive software system like AUTOSAR and a cloud-native platform for containers like Kubernetes. It has an in-vehicle network to connect Electronic Control Units (ECUs) for sensors and actuators, and also software containers for infotainment. For efficient management of those ECUs and containers, this paper proposes an Intent-Based Management Framework for SDVs.

I. INTRODUCTION

Software-Defined Vehicle (SDV) is a new paradigm in Intelligent Transportation Systems (ITS). The SDVs collaborate with other SDVs and infrastructure nodes (e.g., edge servers) for safe and efficient driving and infotainment services through vehicular networks. SDV is regarded as a software-driven platform for autonomous vehicles and electric vehicles. Many automotive companies are developing the SDV platforms such as AUTOSAR [1] and Eclipse SDV [2]. An SDV includes an automotive software system like AUTOSAR and a cloud-native platform like Kubernetes [3].

For the SDV, an intent-based management is required with declarative configuration and management automation. Note that an intent is a declarative command to request a configuration for Service Functions (SFs) for Electronic Control Units (ECUs) and containers. An SDV's in-vehicle network includes ECUs for sensors and actuators, and also containers for infotainment services. Thus, the SDV needs to handle many management tasks for its networks, security, and applications.

II. INTENT-BASED SDV MANAGEMENT FRAMEWORK

For the automatic network configuration of SFs for ECUs and containers in an SDV, an intent-based management is required between the vehicular cloud and SDVs. Fig. 1 shows an intent-based management framework for SDVs. This framework consists of a vehicular cloud and SDVs. The vehicular cloud consists of SDV User (as a network administrator), Cloud Controller (as an orchestrator for a vehicular cloud), SDV Database (as a main repository for SDV management and monitoring), Cloud Analyzer (as a monitoring data analyzer for SDVs), and Cloud Vendor's Management System (as a vendor system to provide cloud-native containers). The SDV is composed of SDV Controller (as a manager for an SDV), SDV Analyzer, SDV Vendor's Management System, and SFs such as router, firewall, anti-virus, navigator, and safe driver for autonomous driving.

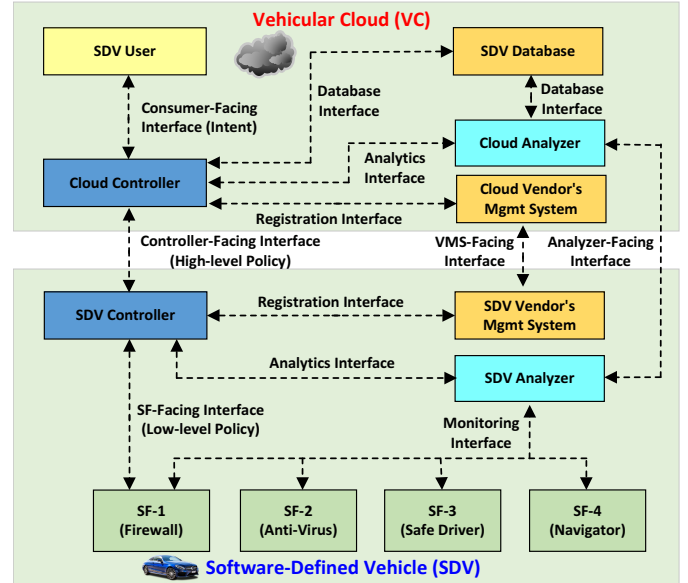


Fig. 1. Intent-Based Management Framework for Software-Defined Vehicles

In Fig. 1, an interface exist between each pair of system components in the SDV framework. The intent, high-level policy, and low-level policy can be expressed in XML documents [4]. They can be delivered to the target components via a message delivery protocol such as NETCONF [5] and RESTCONF [6].

ACKNOWLEDGMENTS

This work was supported by the Institute of Information & Communications Technology Planning & Evaluation (IITP)(No. RS-2024-00398199) and by the National Research Foundation of Korea (NRF)(No. 2023R1A2C2002990).

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