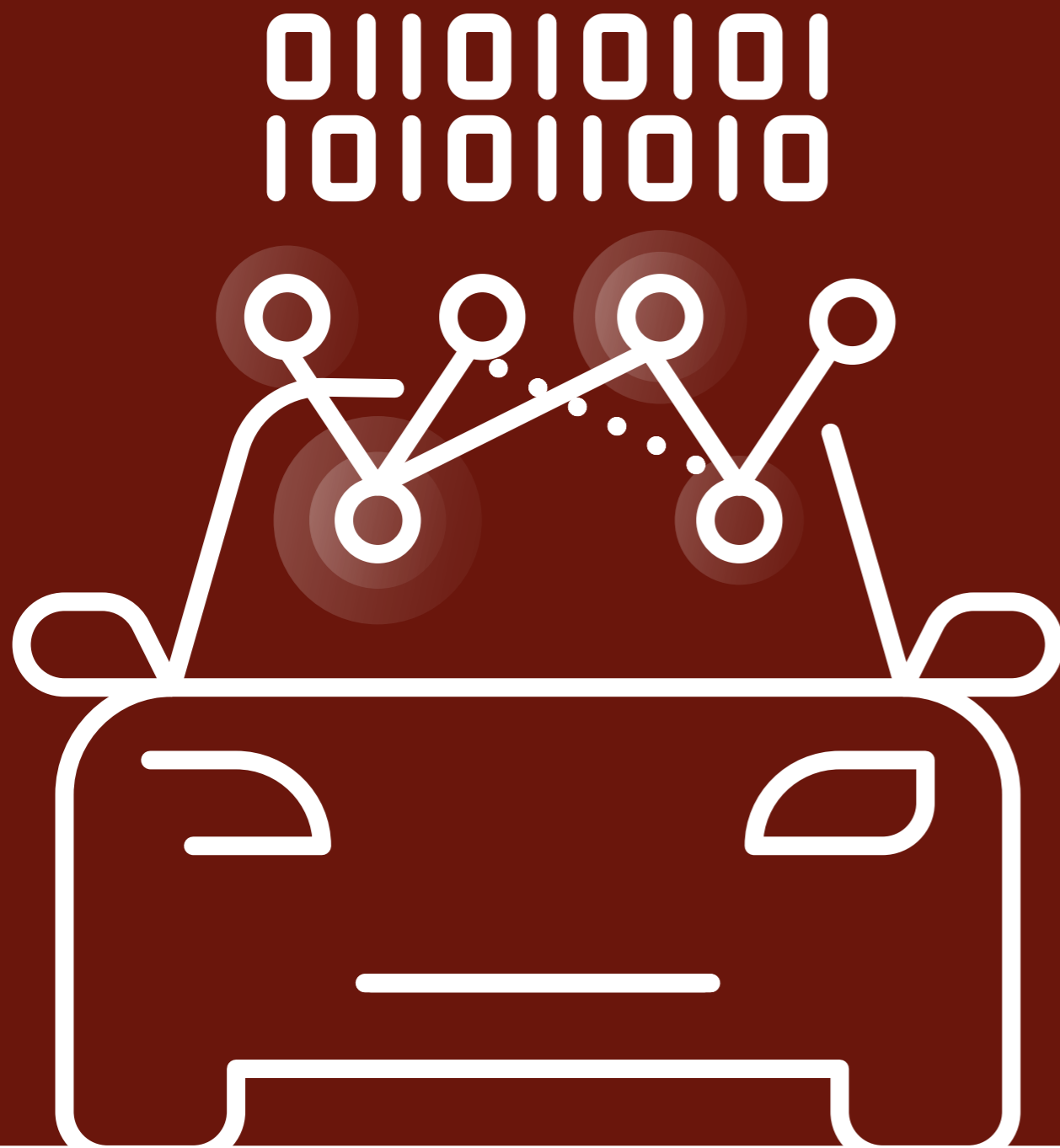# Critical
software

The SOME/IP Protocol

Optimising Advanced Automotive Electronic Systems

The future is electric – and automotive is no exception. The global automotive electronics market is forecast to surpass the value of US$293 billion in 2024, with considerable revenue growth forecast all the way through to 2034[1]. Many cars on the market today comprise complex, interlocking electronic systems. If these fail, the functionality of the vehicle can be severely compromised.

Robust and scalable communication solutions are required to mitigate the risks presented by these systems. The Scalable Service-Orientated Middleware over IP protocol (SOME/IP) emerged as a response to these needs, offering a protocol that facilitates communication between the various components of the vehicle.

In this white paper, we provide a comprehensive overview of some of the standards governing electronics in automotive, highlighting the importance, functionality, and application of the SOME/IP protocol and vsomeip - the reference implementation - within automotive networks.

1 *https://finance.yahoo.com/news/automotive-electronics-market-report-2024-104800478.html*

Understanding SOME/IP

SOME/IP is a middleware designed for service-orientated communication in distributed systems, commonly used in automotive networks. It enables efficient and scalable data exchange between different electronic control units (ECUs). SOME/IP is a key component of the AUTomotive Open System ARchitecture (AUTOSAR) standard, which ensures commonality between software architectures across the automotive industry. This helps to promote the interoperability and reusability of software components.

SOME/IP is crucial for the modern electronic infrastructure of vehicles, providing a unified platform for communication between various subsystems. It supports functionalities such as service discovery, remote procedure call (RPC), and event transmission - all essential for the efficient and safe operation of automotive systems. These features align with AUTOSAR, encompassing in-vehicle communication protocols and software architecture.

Furthermore, vsomeip is a specific implementation of the SOME/IP protocol, which facilitates integration and interoperability between different systems and components within an automotive environment. As a reference implementation of SOME/IP, vsomeip provides a solid foundation for the development and integration of automotive systems, promoting interoperability and facilitating the adoption of open standards in the industry. By adhering to the AUTOSAR standard, vsomeip ensures compatibility with a wide range of automotive applications and enhances the overall robustness and scalability of the vehicle's electronic systems.

Advantages of the SOME/IP protocol

The advantages of the SOME/IP protocol – ranging from scalability and high performance to improved security and cost-effectiveness – make it an attractive choice for building distributed systems - such as vehicle architectures, where reliable and efficient communication between ECUs is essential.

Lightweight and efficient: SOME/IP is designed to be lightweight and efficient, making it ideal for use in resource-constrained environments.

Standardised: SOME/IP is an open and standardised protocol. It can be used by any automotive manufacturer or supplier, helping to ensure compatibility and interoperability between different systems and components.

Supports multicast communication: SOME/IP supports multicast communication, which means that multiple electronic control units (ECUs) can receive the same message simultaneously. This helps to reduce network traffic and improve efficiency.

Error handling and message delivery: SOME/IP includes mechanisms for handling errors and ensuring message delivery. This helps to ensure that messages are received and processed correctly, even in the presence of network errors or congestion.

Flexibility: SOME/IP is data format agnostic, making it a flexible and versatile protocol that can be used for a wide range of applications.

Scalable: The scalability of SOME/IP means it can be used within small and large networks, making it the ideal protocol for use in complex automotive systems where multiple ECUs need to communicate with each other.

Supports both IPv4 and IPv6: SOME/IP supports both IPv4 and IPv6, enabling compatibility with both legacy and modern networks and ensuring interoperability between different systems and components.

High performance: SOME/IP is designed for high performance. It can handle large amounts of data and quickly processes messages, enabling rapid and efficient communications between ECUs.

Security: SOME/IP includes security features such as message authentication and encryption. Messages can be sent and received securely, and sensitive data is protected from unauthorised access.

Exploring vsomeip

The vsomeip library is an implementation of the AUTOSAR SOME/IP protocol. Built using C++ and developed within the BMW Group, it is a critical piece of software for modern automotive communication. It enables Unix Domain Socket (UDS) and Transmission Control Protocol (TCP) communication between applications within the same device, and additionally, User Datagram Protocol (UDP) and TCP between multiple devices, ensuring seamless data transfer across a vehicle's electronic systems. The data transfer is achieved using a routing manager and service discovery mechanisms, offering endless configuration possibilities to satisfy numerous complex use cases.

This technology - encompassing vsomeip and associated binding projects – has been widely adopted by the BMW Group and other manufacturers. Deployed in millions of cars to date, it supports infotainment systems, managing data transport for audio control, navigation, entertainment, and driving metrics. Although vsomeip is not used in safety-critical domains, its reliability is paramount in maintaining user satisfaction and vehicle performance.

The architecture of vsomeip is multiplatform - including support for Real-time Operating Systems (RTOS) - providing flexibility and adaptability across different vehicle models, electronic systems, and operating systems.

Key features include usability enhancements through Franca/Fibex Interface Definition Languages (IDL), standard logging via DLT (Diagnostic Log and Trace, another AUTOSAR standard), robust security measures using configurable policies and Security-Enhanced Linux (SELinux) integration, and end-to-end encryption mechanisms. These security features ensure the system is secure from both internal and external threats.

A SOME/IP use case

In a modern connected car, the infotainment system must interact seamlessly with the vehicle's navigation system, the digital instrument cluster, and the Advanced Driver Assistance Systems (ADAS). SOME/IP provides a standardised communication framework allowing these diverse ECUs to exchange data efficiently and reliably over an IP network.

For instance, when a driver enters a destination into the navigation system, the navigation ECU can use SOME/IP to send route information to the digital instrument cluster, ensuring the driver sees turn-by-turn directions on the dashboard. Simultaneously, the infotainment system can access this data to offer relevant information, such as nearby points of interest or traffic updates. This integration is crucial for delivering a cohesive and fully user-friendly experience in today's advanced vehicles.

Open-source community

The Connected Vehicle Systems Alliance (COVESA), formerly known as the GENIVI Alliance, is an organisation promoting the standardisation and interoperability of automotive systems.

The relationship between vsomeip and COVESA is emblematic of the constructive collaboration within the automotive software ecosystem. vsomeip, as an implementation of the SOME/IP protocol, serves as a vital communication framework for electronic components in vehicles.

The vibrant open-source community surrounding vsomeip demonstrates an elevated level of interest and engagement, evident in the proliferation of forks, clones, issues, and pull requests. The active participation of both partners enriches the project with continuous improvements and innovative solutions.

Together, vsomeip and COVESA exemplify the power of open collaboration in driving forward the development of connected vehicle technologies, paving the way for a more integrated, efficient and software-defined automotive future.

How Critical Software can help

Critical specialises in delivering high-quality support and continuous improvements. We address challenges such as multi-threading and concurrent data access, which require careful architectural and implementation decisions to protect highly concurrent and highly distributed systems from unexpected issues. This contribution is often challenging, as the vastness of the use cases that vsomeip covers makes it impossible to thoroughly vet them all.

To ensure high quality systems and protect against system failures, part of the development effort has been dedicated to ensuring a good test coverage. To ensure robust and reliable software deployments, the code is tested both at the unit level and the functional level, incorporating a compliance suite tailored to the requirements of AUTOSAR.

Looking to leverage our expertise in developing secure electronic systems in automotive?

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We are CMMI Maturity Level 5 rated.

For a list of our certifications & standards
visit our website.