SIEMENS
Ingenuity for life

Capital VSTAR Ethernet

Benefits

- Deploy latest Ethernet technology
- Support for technology leading OEM's
- Solution for a wide range of vehicle applications
- Scalable from signal based to large data / bandwidth demanding applications
- Leverage flexibility of service oriented architectures

Features

- AUTOSAR compliant IP communication over Ethernet
- Signal-based and service oriented communication
- Protocol add-ons for IEEE/IETF RFCs standards
- Firewall, hardware security, AVB/TSN
- Multicore enabled communication stack

Advanced ECU design with AUTOSAR software and tooling

Capital® VSTAR™ is Siemens' implementation of the AUTOSAR standard. It is a complete offering with tools and software to meet all ECU platform needs from ECU extract updates to software platform configuration.

Ethernet

Since its introduction, Automotive Ethernet has been increasingly used throughout the vehicle for a range of applications. With increased software functionality in cars and computation capabilities of ECUs, the communication among ECUs became more complex along with the throughput that has grown in bandwidth. Integration has become a challenge for OEMs Tier-1s to manage multiple factors such as hardware costs, weight, placement and size of ECUs. Historically a car platform scaled in functionality by adding ECUs and/or vehicle busses to support computational power and increase the bandwidth. With the current approach, managing the physical installation space, wire length and weight along with keeping the associated costs in economical limits becomes a difficult architecture task. This demanded the introduction of Ethernet as communication medium in the vehicle and triggered a transition of how ECUs convey information or pass control to each other to address the faced challenges. This includes the transition from traditional communication technologies with signal based communication to service based communication and its support in new protocols and basic software. ECU functionality within these architectures use signal based communication and is bound to a specific type of ECU. The ECUs involved in the exchange of signals are statically defined in the communication matrix of the vehicle, thus making dynamic changes in the system is likely to impact seemingly unrelated parts. Ethernet-based SOME/IP enabled ECUs have multifold advantages in the vehicle architecture. They offer

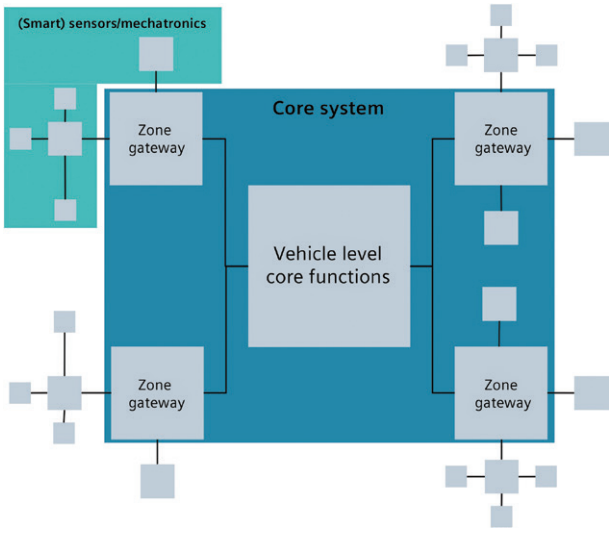

Figure 1. Zonal architecture example.

Capital VSTAR Ethernet

high bandwidth together with higher flexibility for distributing software components in the system as communication partners can be learned and services can be discovered or offered. Additionally, the protocols above the media access layer are already established. New vehicle platforms can leverage the benefits of SOME/IP and switched networks to deploy scalable zonal architectures. Those architectures group functionality and responsibilities into zones where mechatronic systems along with their preprocessing, sensors / actuators are connected to zone gateways. Vehicle functions themselves are realized within the core network on a unified Ethernet backbone accessing the zone gateways. Moving to an Ethernet based zonal architecture removes the complexity of the data path since SOME/IP abstracts this and less routing between different bus technologies in the vehicle backbone will be present. Capital VSTAR basic software and tooling allows the exploration and the design of the systems ECUs within the new solution space of an Ethernet enabled vehicle. Capital VSTAR is production proven in Ethernet series projects and supports requirements for next generation systems such as zonal architectures or central compute platforms.

<table>
<tr><td>Layer</td><td colspan="3">Audio Video Time Sync / Signal- / Service-oriented Communication</td><td>Diagnostics & Bootloader</td><td>Calibration & Measurement</td></tr>
<tr><td>7</td><td rowspan="5">TSN</td><td rowspan="3">SOME/IP Service Discovery</td><td rowspan="3">Signals / PDUs over COM / LdCom (Large Data COM)</td><td rowspan="3">DoIP / OEM specific Diagnostic Transport Protocol + Ethernet enabled Bootloader</td><td rowspan="3">XCP over Ethernet</td></tr>
<tr><td>6</td></tr>
<tr><td>5</td></tr>
<tr><td>4</td><td colspan="4">TCP / UDP</td></tr>
<tr><td>3</td><td colspan="4">IP</td></tr>
<tr><td>2</td><td colspan="5">IEEE Ethernet Media Access Control + VLAN</td></tr>
<tr><td>1</td><td colspan="5">IEEE Ethernet Physical Layer (IEEE 100Base-T1, IEEE 1000Base-TX, IEEE 1000Base-T)</td></tr>
</table>

Figure 2. Protocol stack.

Ethernet features

The AUTOSAR standard components and protocols supported by Capital VSTAR enables real time embedded systems. Expanded support for a range of use cases addresses requirements for Ethernet and IP based product, these Capital VSTAR features include:

- *Ethernet protocol stack* for communication and management over Socket Adaptor (SoAd), Ethernet Interface (EthIf), Ethernet State Manager (EthSM), UDP Network Manager (UdpNm)
- *TcpIp/Udp* for reliable or overhead less socket communication on IPv4 and IPv6 and related protocols in Scalability Class 1 + 2
- *Time Synchronization (EthTSyn)* for network wide distributed and synchronous time base from e.g. Precision Time Protocol (PTP)
- *VLAN* support for network separation and traffic shaping/prioritization.
- *Ethernet driver software*, broad support of PHYs, Ethernet Controllers and Ethernet-capable Microcontroller
- *Signal based communication* for traditional vehicle communication on Ethernet over IP.
- *Service Discovery* for announcement and discovery of services within the vehicle network
- *SOME/IP* for service oriented communication with built-in transformation and serialization of data structures/ objects
- *AVB/TSN protocols* for time sensitive Ethernet communication without frame drop and worst case latency
- *DoIP and OEM specific protocols* for diagnostic tester connection and software download
- *Ethernet based bootloaders* for software downloads and end of line programming
- *Calibration & Measurement over XCP* for parameter application and test
- *Security features* such as Firewall and secure communication

Example applications:

- Vehicle network backbone
- Infotainment audio/video
- Advanced Driver Assistance Systems (ADAS)
- Comfort functions

Siemens Digital Industries Software
siemens.com/software

Americas +1 314 264 8499
Europe +44 (0) 1276 413200
Asia-Pacific +852 2230 3333

83183-C3 2/21 H