The Need for Automotive Ethernet Conformance and Interoperability Testing

The Problem

Car technology is rapidly increasing. What was once science fiction is quickly becoming reality. All of these growing automotive applications are driving up the bandwidth requirements. In response, automotive manufacturers are adding more and more computer-based systems, applications, and connections. Due to this complex cabling, the wiring harness is the 3rd highest cost component in a car (behind the engine and chassis).

The wiring harness is also the 3rd heaviest component. Any technology that reduces this weight directly contributes to fuel economy.

The cost of these electronics – and wiring harness to support them in terms of cabling, network interfaces, and onboard computing power – is growing. Ethernet deployment can, and will, reduce these costs. Recent technology developments make Ethernet viable for use in cars.

Automotive Ethernet will influence traditionally independent electronic control units (ECUs) working on dedicated bus systems to leverage the Ethernet shared media and communicate with each other. Thus, Automotive Ethernet will call for greater degree of interoperability driven through adherence to standards. Given that Infotainment and ADAS systems will be the initial targets for bringing in innovations and value for consumers by leveraging increased bandwidth made available by Ethernet, it is critical to ensure interoperability and safety within these systems.

The cost and adverse impact of non-interoperability can be immense. It is very likely that certain issues can escape the production testing since all kind of real life scenarios is often difficult to comprehend and reproduce in house testing. Any real life interoperability issue has the potential to cause a costly vehicle recall post production.

It is important for automotive manufacturers to enforce quality and service level checks on ECU code by enforcing interoperability and standards compliance tests and reports. These tests and reports can be easily obtained by running Ixia's IxANVL interoperability/standards conformance test suite in a single click.

It is a bigger task for the ECU software suppliers and stack manufactures. In order to avoid late discovery of interoperability and protocol related issues, it is important to build in quality right form design cycle. A late discovery of problem can lead to wastage of valuable time and higher project cost since it is very expensive to go back in later test phases and figure out where the problem is, especially when ECUs from multiple vendors and stack providers are present in the network. It is also very expensive to fix issues back in the stack and percolate it to many different ECU code where it has already got into.

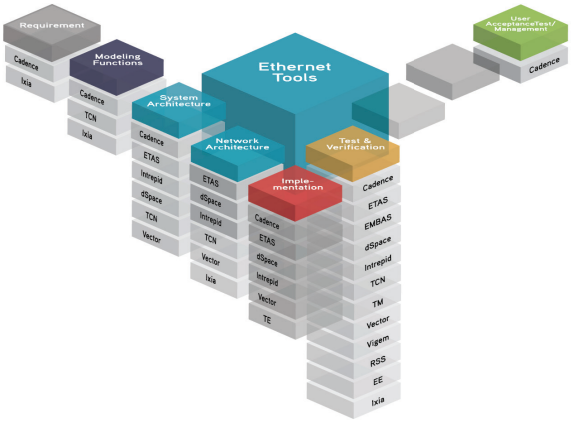
SOLUTION HIGHLIGHTS

Automotive Ethernet needs interoperability and conformance testing due to the fact:

- Traditionally independent systems now need to work together via a shared bus
- TCP/IP is designed to enable multiple devices to communicate with each other
- Wireless connectivity will expose internal stack to external threats – hence, internal systems may be exposed to protocol spoofing, authentication, and negative protocol behavior related and protocol attacks.
- It is important to start building quality from early phases of Automotive V-Cycles.

With the use of a centralized Ethernet system, comes the threat of intrusion and malicious attacks – meaning security is a concern. These systems need to be demonstrably "fit for the road" before they hit main markets – the cost of recalls is immeasurably higher than getting it right the first time. Security and vulnerability testing ensure that products are fit for the market.

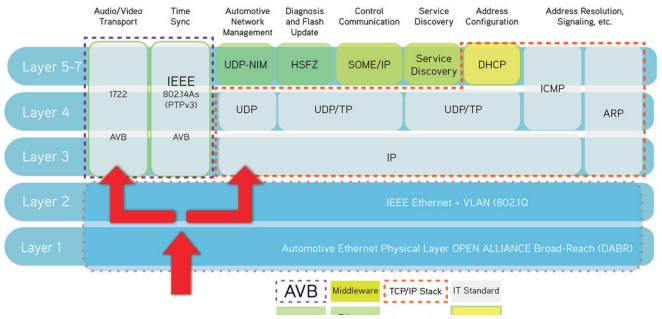
All of this points to a testing process and tools that are comprehensive, reliable, and able to support the earliest phases of the automotive V-cycles.



Conformance Testing

Verifying that your implementations are consistent with standards – in a timely and trustworthy manner – is imperative to getting to market on time:

- Protocol stacks from different vendors must be interoperable to avoid late discovery of field problems
- Systems needs to be resilient
- Systems should be able to handle malformed or crafted packets
- Ability to handle negative protocol behavior by other systems
- Systems should be able to support strong security posture
- Minimize risk of stack getting compromised in field deployments



- Development needs
  - Reduction of stack development time through advance exposure to real life scenarios and test methodologies
  - Correct protocol design
  - Early fixing of defects down the integration chain
  - Prevention of future collaterals
  - Preparation for lab certifications
  - Simpler testing, easier to debug, isolation of failure points in a complex stack implementation, ability to rapidly analyze and retest with repeatability
  - Automation and regression needs

Ixia Test solution

Ixia's IxANVL helps auto and component manufacturers verify that their systems and products conform to the IEEE and AUTOSAR standards, and that they will interoperate with legacy systems. It also tests conformance and interoperability for:

- AUTOSAR (AUTomotive Open System ARchitecture), an open and standardized automotive software architecture jointly developed by automobile manufacturers, suppliers, and tool developers.
- GENIVI, a competitive, Linux kernel-based operating system, middleware and platform for the automotive in-vehicle infotainment (IVI) industry.

Ixia IxANVL is:

- Industry leading protocol interoperability test suite
  - 500+ IPv4 test cases for Infotainment, ADAS ECU stack testing based on AUTOSAR and/or GENIVI stacks
  - 700+ tests for IPv6 stack testing
  - Test capability for UDP and TCP over both IPv4 and IPv6
  - Wide protocol coverage with hundreds of automated tests for each supported protocol, including negative tests

Total test count: 500+

Automotive Ethernet Network IPv4 Infrastructure conformance	Main RFC and supporting RFC's
AUTO-ETH-UDP	768, 1122
AUTO-ETH-IPv4	791, 1122
AUTO-ETH-ICMPv4	792, 1122, 1812
AUTO-ETH-TCP Core	792, 1122, 2460
AUTO-ETH-ARP	826
AUTO-ETH-TCP-Advanced	2001, 1191, 2385, 2463, 1981, 896, cubic-tcp-draft
AUTO-ETH-DHCP-Client	2131, 2132
AUTO-ETH-DHCP-Server	2131, 2132
AUTO-ETH-DHCP-AutoConf	AUTO-ETH-UDP

Total test count: 500+

Automotive Ethernet Network IPv6 Infrastructure conformance	Main RFC and supporting RFC's
AUTO-ETH-IPv6	2460, 2464
AUTO-ETH-IPv6CP	2472
AUTO-ETH-MLD	2710
AUTO-ETH-DHCPv6-Client	3315
AUTO-ETH-DHCPv6-Server	2131
AUTO-ETH-Mobile IPv6	3775
AUTO-ETH-IPv6ov4	4213, 2529, 3056, 3068
AUTO-ETH-NDP	4861, 4291
AUTO-ETH-ICMPv6	4443, 2463
AUTO-ETH-IPv6-AutoConf	4862

Ixia Worldwide Headquarters
26601 Agoura Rd.
Calabasas, CA 91302

(Toll Free North America)
1.877.367.4942

(Outside North America)
+1.818.871.1800
(Fax) 818.871.1805
www.ixiacom.com

Ixia European Headquarters
Ixia Technologies Europe Ltd
Clarion House, Norreys Drive
Maidenhead SL6 4FL
United Kingdom

Sales +44 1628 408750
(Fax) +44 1628 639916

Ixia Asia Pacific Headquarters
21 Serangoon North Avenue 5
#04-01
Singapore 554864

Sales +65.6332.0125
Fax +65.6332.0127