PUBLISHED ARTICLE

molex

AN ADAPTIVE APPROACH: CHALLENGES AND PROPOSED SOLUTIONS

BY MIKE POTTS, LEAD SYSTEMS ARCHITECT, MOLEX CONNECTED MOBILITY/TRANSPORTATION AND INDUSTRIAL SOLUTIONS DIVISION

The role that autonomous/adaptive driving plays in reducing accidents is both evident and crucial. For instance, collision-avoidance systems can mitigate the limitations of human reaction time that contribute to many accidents.

Additionally, globally projected automotive sales are flat or declining while the length of time owning a single car is increasing. Adaptive applications can ensure functional requirements are capable of hardware and software upgrades in order to meet new safety requirements throughout the lifetime of the vehicle. Furthermore, OEMs continue to look for opportunities to both cut or maintain existing cost structures while delivering products based on value-added consumer demand and support new automotive technologies. An adaptive approach can support the economical implementation of cutting-edge capabilities.

In other words, an adaptive approach can translate marketplace challenges into substantial opportunities. Below we summarize some of these challenges, starting with the most serious – driver safety.

CHALLENGE #1

Studies have shown that most traffic accidents are caused by human error. Here are some statistics on the reaction times involved with braking to avoid hitting something:

Approximately 90% of information processed is visual (e.g., a deer in the road)

Approximately 13ms(at best) to process an image (e.g., "Oh, no! There's a deer in the road!")

Best human braking response: Approximately 552ms, which equates to:

- 40.5 ft. @ 55 mph
- 55.5 ft. @ 75 mph

Typical human braking response: Approximately 1,500ms, which equates to:

- 121.5 ft @ 55 mph
- 166.5 ft @ 75 mph

Approximately 79.32% of braking response are accurate

In summary, the milliseconds it takes to perceive a deer in the road and then apply the brakes may cause accidents nearly 20% of the time.

SOLUTION: ADAPTIVE APPLICATIONS

Adaptive applications have the capability to learn and adapt desired learning to pervasive behavior without human-machine-interface (HMI) influences. The application can autonomously adapt to current needs based on software integration of learned vehicle characteristics and information provided by artificial intelligence (AI) ecosystems. The resulting decrease in latency means the vehicle reacts more quickly to hazards, improving the safety of drivers and passengers. In fact, the U.S. Department of Transportation estimates that adaptive driving may reduce traffic accidents by 94%.

Some examples of adaptive applications include the following:

- Road hazard notification and avoidance
- Adaptive cruise/steering/braking control and collision avoidance
- Driver/in-cabin monitoring
- Lane keeping and departure warning
- Automated parking
- Dynamic and matrix lighting
- L2-L5 ADAS/AD sensing and ecosystem location functions
- Deterministic quality of service (QoS) classifications

Originally Published on Experience Molex (July 2020)

CHALLENGE #2

OEMs also need to design architectures that can be used for multiple builds (i.e., low-, mid- or high-end platforms). One of the differences among OEM builds is the enablement of software/applications based on the installed level of hardware.

SOLUTION: ADAPTIVE NETWORK

An adaptive network is a network with an architecture and component ecosystem that safely and securely allow for the dynamic delivery of centric data based on application analytics and deterministic data communication requirements.

Examples:

In-vehicle-network (IVN)-based enablers that allow for the distribution of all or partial object-based data (e.g., LiDARs, HD cameras), as determined by need for that data

Distributed applications that provide improved processing and safety/redundancy capabilities, utilizing service-based protocols and applications

Reduced IVN latency and increased vehicle reaction through the availability of programmable management objects used to support deterministic data delivery requirements

CHALLENGE #3

OEMs must meet the safety requirements demanded by consumers and federal regulations (e.g., backup cameras, airbags, CAFÉ standards, seat belt alerts, child safety seats, among others). Additionally, they must safely implement updates, such as the introduction of new applications, de-bugging programs, security and V2X-regulated communication frequency/bands, using Wi-Fi or wireless technologies (i.e. 802.11p/WiFi6, 4G/5G+PC5, 5G NR, DSRC vs. C-V2X).

SOLUTION: ADAPTATIVE AWARENESS

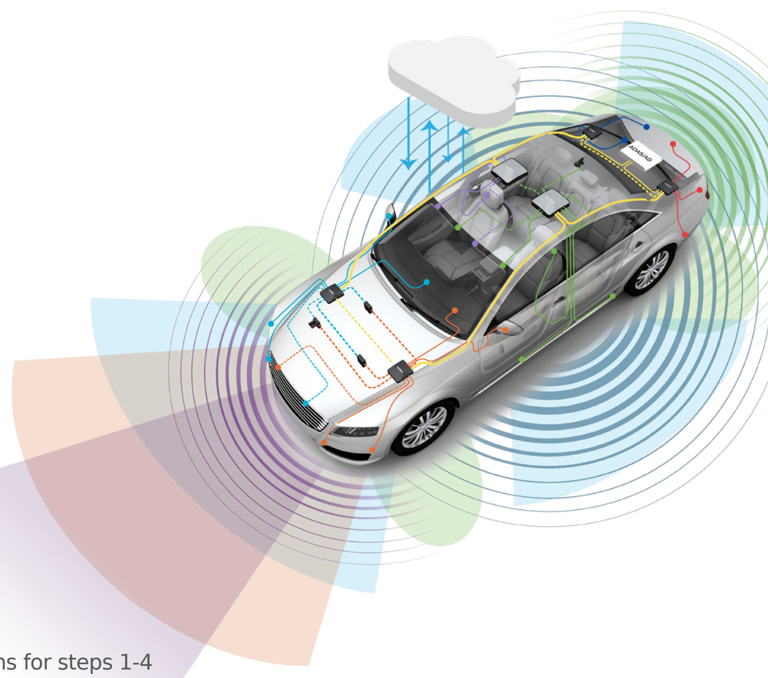
An intelligent virtual network model that allows for flexible system-level knowledge of the surrounding ecosystems, acquiring and delivering information based on learned behaviors and adaptation to perceived conditions is the answer. Here are some examples:

Adaptive enablers

- V2X technology
- Imaging devices
- Detection devices
- ECU processing capabilities
- Network communication IEEE standards, ASA Alliance and Wi-Fi Alliance

Automotive IoT (Internet of Things)

AI learned behaviors



HOW DO IMPLEMENT AN ADAPTIVE APPROACH?

With a 5-Step Solution:

1. Identify a common method for network infrastructure components and applications to communicate with each other.
2. Design from a system-level viewpoint using a tool-chain process.
3. Determine ecosystem and implementation requirements.
4. Determine adaptive network QoS mechanism(s).
5. Re-evaluate adaptive application requirements based on the decisions for steps 1-4

THE MOLEX ADVANTAGE

Our capabilities and advanced technology development allow us to maintain a customer-focused direction to provide and develop solutions designed and adapted to both existing and future architectures. The result: our customers deliver high-value products to consumers.

Additionally, Molex focuses on system-level integration of applications, networking hardware and software elements that will support the deterministic delivery requirements of data.

To learn more www.molex.com/connected_vehicle_architecture

Order No. 987652-2521 USA/0k/GF/2020.07