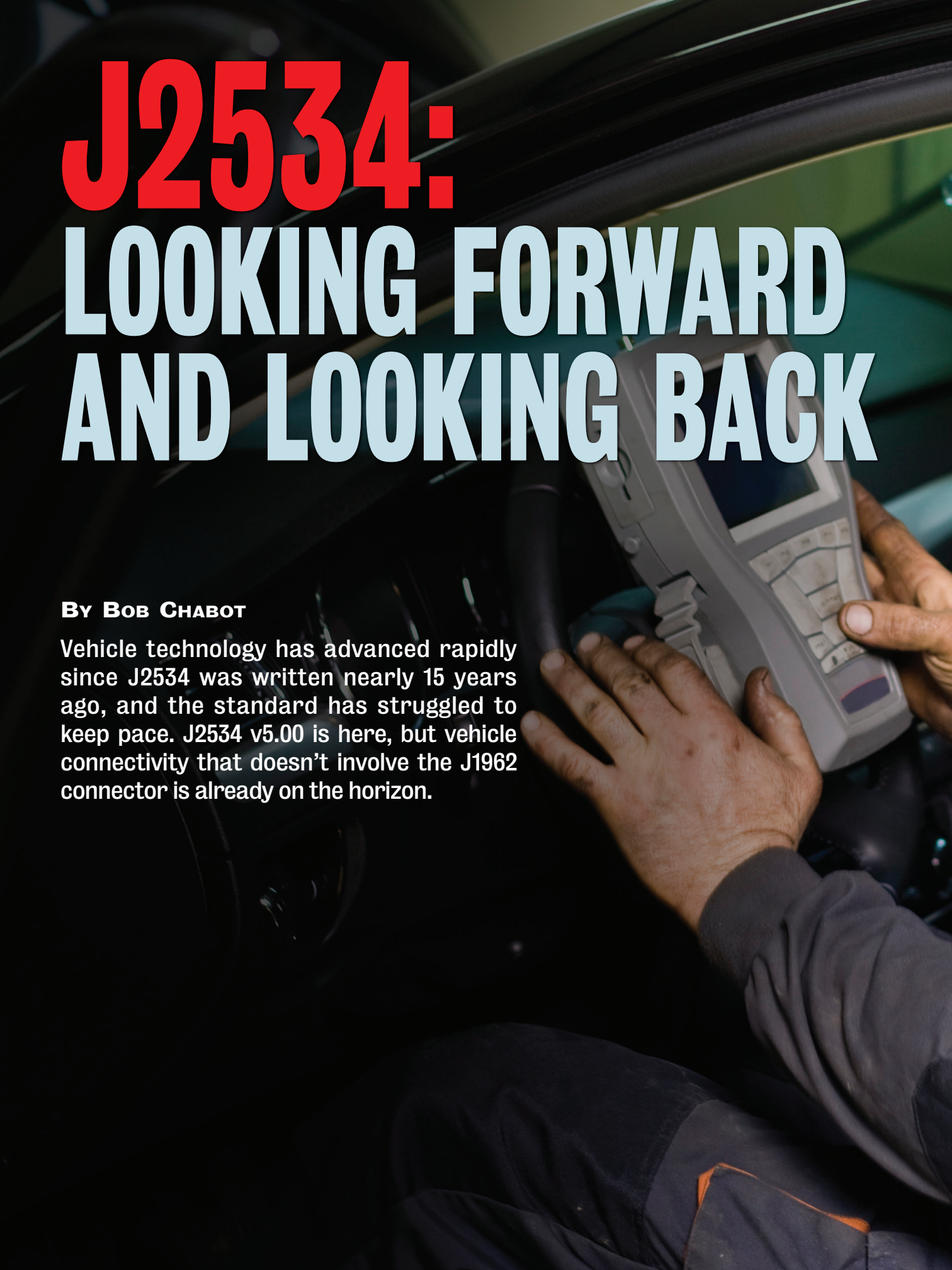


J2534: LOOKING FORWARD AND LOOKING BACK

A close-up photograph of a person's hands using a grey diagnostic tool on a car's dashboard. The tool has a screen and several buttons. The person is wearing a dark grey long-sleeved shirt. The background is dark and out of focus, showing parts of the car's interior.

BY BOB CHABOT

Vehicle technology has advanced rapidly since J2534 was written nearly 15 years ago, and the standard has struggled to keep pace. J2534 v5.00 is here, but vehicle connectivity that doesn't involve the J1962 connector is already on the horizon.



The future of J2534—the Society of Automotive Engineers' recommended practice for pass-thru vehicle programming—has been under continual development and refinement for years. It's just never been quite good enough. Granted, J2534's many versions have propelled vehicle serviceability forward. The proliferation, adoption and investments in associated vehicle communication interface devices (VCIs), service procedures, training and other resources by shop owners and technicians are evidence of this.

But the evolution of, and focus on, J2534 comes with a paradox. It has also hamstrung serviceability. The inertia that J2534 programming has massed has also blinded the automotive aftermarket to arguably more efficient and effective software reprogramming alternatives. This myopia around J2534 also ignores new market realities, which include cybersecurity, privacy and active attempts by automakers and their suppliers (OEMs) to control access to the software they've embedded into vehicles.

In the last week of October 2015, SAE published J2534 Version 5.00 (v5.00), its latest iteration of the standard. The new J2534 v5.00 specification has four components:

J2534-1 - Defines features for a VCI device that performs software reprogramming of electronic control modules (ECMs).

J2534-2 - Defines OEM-specific extensions for optional features and protocols that perform ECM software reprogramming, so an OEM can allow reprogramming of all vehicle ECMs using a single J2534 device.

J2534-3 - Defines compliance testing to verify that an OEM's J2534-1 VCI device meets all the requirements specified in J2534-1, so reprogramming applications from that OEMs will work with all compliant VCIs.

Photo: Thinkstock

J2534: Looking Forward and Looking Back

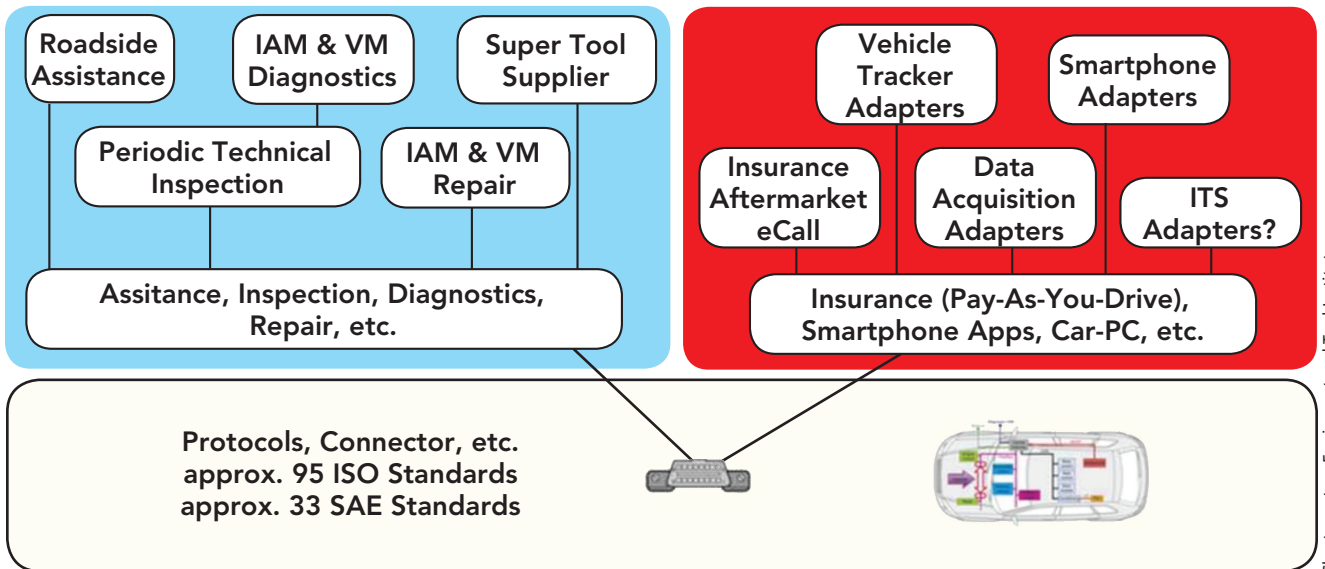


Chart courtesy: Equipment and Tool Institute

Over the lifetime of J2534, the number of use cases for access to vehicle data via the J1962 connector has risen steadily. More use cases are expected as telematics, connected cars and intelligent transportation systems grow. In addition, cybersecurity concerns are driving OEMs to consider alternative means of providing J2534 functionality, such as over-the-air reflashing.

J2534-4 - Defines recommended practices and needs that OEMs must disclose for application requirements, such as protocols, physical layers, J1962 connector pin selection (what's on which pin?), network connections, Windows PC requirements, etc.

"J2534 v5.00 is a very tight specification that addresses many of the problems that earlier versions of J2534 had," explained Greg Potter, executive manager for the Equipment and Tool Institute and a member of the SAE E/E System Diagnostic Standards Committee, which oversees J2534. "Until now, implementing, testing and approving earlier J2534 devices has been an ongoing nightmare. Prior versions of the specification were vague and could be interpreted differently,

so very few 'out-of-the-box' success stories resulted. In addition, adequate compliance testing, to ensure different J2534 devices acted 'as they should,' was also lacking.

"J2534 v5.00 provides improved functionality to service and repair professionals," Potter continued. "The newest version can multiplex communications over several channels, which allows technicians to re-program vehicles much faster. The new version also includes VCI device detection and connection management features that enable technicians, who often have their reprogramming laptop and J2534 device wirelessly connected to more than one vehicle, to securely differentiate, isolate and authenticate each ve-

hicle connection. In addition, new v5.00 will be backwards compatible and capable of running and using earlier J2534 API versions. It's also forward-looking. J2534 v5.00 can accommodate both Diagnostic over Internet Protocol (DoIP) communications that enable wireless, remote 'over-the air' (OTA) diagnostics and software updates, as well as ethernet-based vehicle communications architecture, which will be in vehicles in a few years."

Challenges Ahead

"SAE committees develop national standards used by the industry," noted Bernie Carr, senior product development manager for Bosch Service Solutions and a member of the SAE

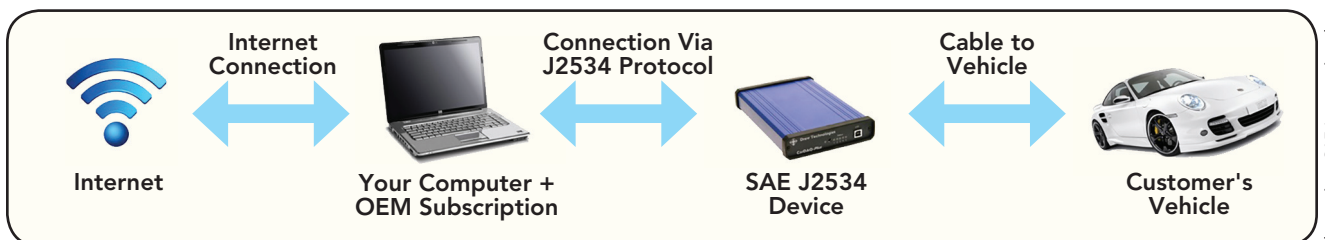


Illustration: SAE International

OEM, SAE and aftermarket cybersecurity experts cite J2534 and other VCI devices as being prone to hacking. OEMs are actively seeking more secure means to protect vehicle and consumer data. For example, if a malware-harboring vehicle is brought in for service, the vehicle could spread the malware to the service facility's diagnostic testing and programming tools, other connected equipment and other vehicles being serviced.

J2534: Looking Forward and Looking Back

Committee. He appealed to service professionals for help. “There’s joy in that as an SAE committee member, but we need feedback and participation, especially from technicians and others who provide software reprogramming. For example, while the J2534-1 and J2534-2 components are complete and published, both J2534-3 and J2534-4 are still in the draft stage.

“We have lots of participation from OEMs and tool/equipment manufacturers, but we really could use your help. So let me make this call-to-action: If we’re going to get even close to creating a solution that works everywhere, on every vehicle everywhere, for every use case, we need and want your user experiences, feedback and participation, especially for these last two v5.00 components. We could really use your help.”

Automakers and J2534 device manufacturers acknowledge that full implementation of v5.00 will take some time and considerable investment.

“Preparing to implement v5.00 presents economical and logistical challenges for OEMs, in addition to a lot of time and effort,” cautioned Kurt Immekus, a regulatory specialist at Volkswagen Group of America. “It’s taken years for SAE to finalize every version of J2534, including v5.00. Implementing any new standard requires the many automakers, toolmakers and jurisdictions involved to attain a common understanding of the technical and legal aspects. As a result, once a new standard is published by SAE, it can take several more years of lead time to develop, update and test diagnostic and reprogramming tools.”

“To update to v5.00, huge costs are involved,” added Jill Saunders, a product engineering specialist at Toyota Motor Sales USA. “OEMs must cover all of the possibilities across all the variations for all model years. Updating just one model year for v5.00 requires substantial testing

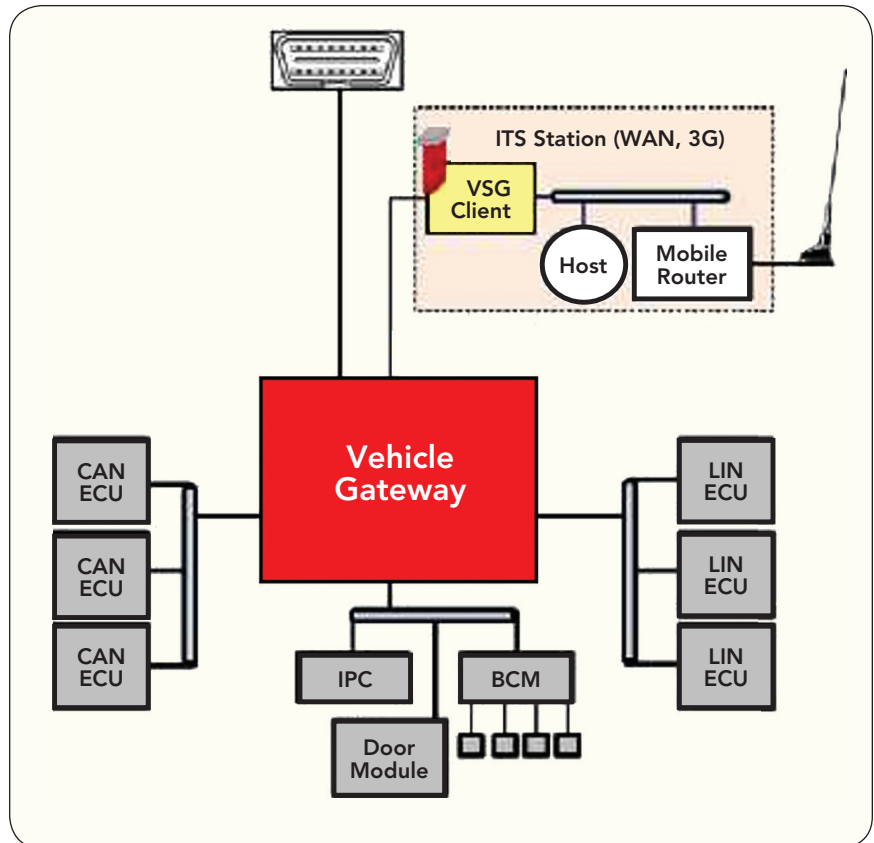


Chart courtesy Equipment and Tool Institute

Vehicle gateway modules can facilitate access to vehicle communication networks and data by both J1962 and wireless interfaces. Positioned between the J1962 connector and vehicle networks, gateways can also control the level of access to vehicle data by multiple users with different data needs. For example, gateways can authorize an OEM engineer to have greater access to networks and data than a technician, who in turn would have more access than a DIYer, a parts store, insurance dongle or smart street sign.

and validation by automakers. For example, updating just one model year at Toyota requires more than 84,000 separate tests. Updating all model years for v5.00 compounds the task. Then, each automaker’s J2534 v5.00 solution must be provided to SAE for compliance testing.

“We also need to remember it isn’t all about the standards,” suggested Brian Herron, vice president of Drew Technologies, a manufacturer of J2534 VCI devices. “Let me ask this question: If we had the new v5.00 specification—which I love and urge everyone to move toward—back in 2004, would the automotive service world today be any dramatically different, let alone perfect? I think the answer is ‘No.’ Sure the specification

was part of the problem, but just a small part, in my opinion.

“The bigger parts of the problem back then were twofold,” Herron went on. “First, we were migrating from hand-held tools to PC-based systems. I don’t think anybody—OEMs, toolmakers, technicians, etc.—really knew what we were doing back then. We were deploying systems that would sometimes flash a module, but wouldn’t allow the diagnostic steps to finish the job, so the vehicle wouldn’t work. Sometimes the modules weren’t even recoverable. In addition, the industry has undergone a vehicle serviceability transition. Ten years ago, aftermarket technicians were not a focus for OEMs. Right-to-repair has driven

J2534: Looking Forward and Looking Back

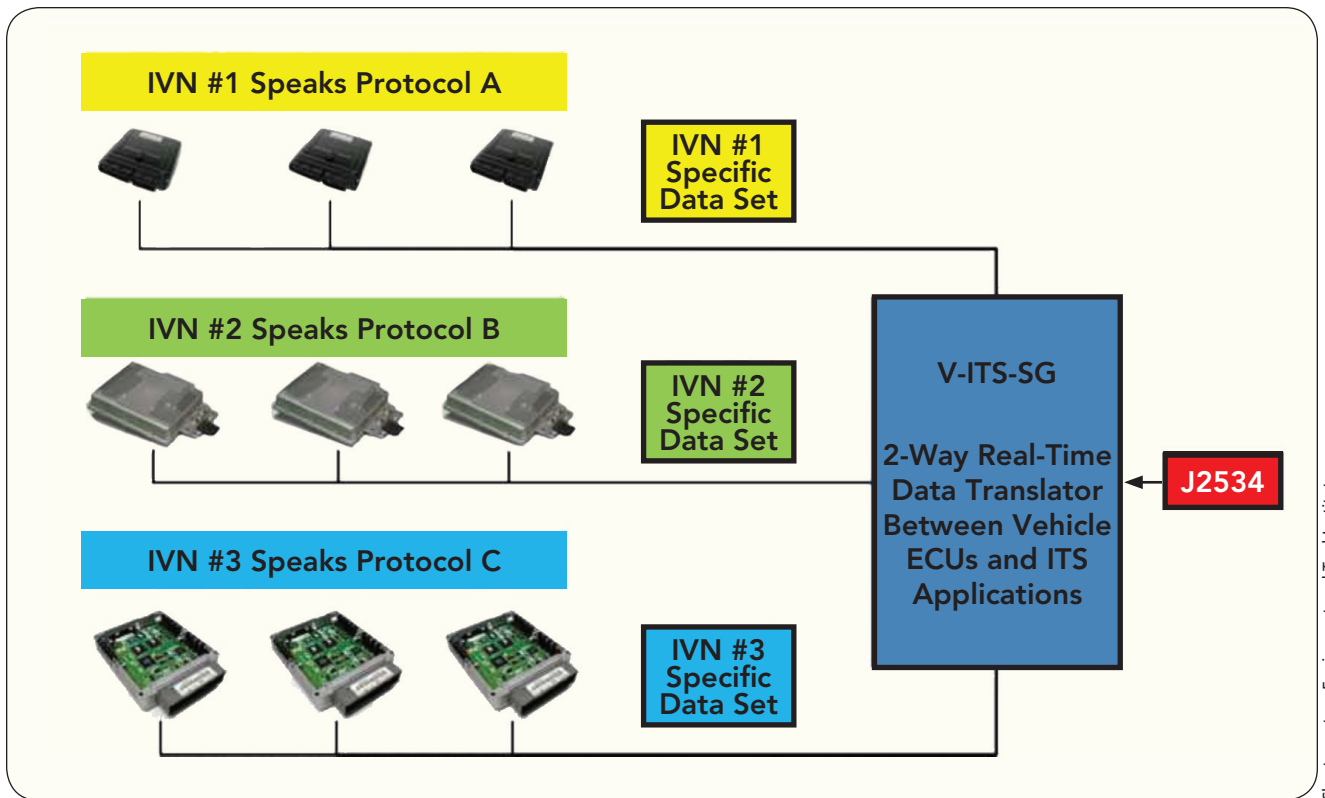


Chart courtesy Equipment and Tool Institute

Vehicle gateways can also act as a translator between various on-board communication protocols (e.g., CAN, MOST, Ethernet), accommodate various wireless vehicle connectivity protocols (e.g., Bluetooth, Wi-Fi, DoIP) and facilitate J2534 software programming, whether it continues to be delivered via VCI devices or some other means the industry migrates to.

change. It's shifted OEMs' focus to being increasingly on aftermarket technicians who provide the majority of all service and repairs annually to vehicle owners."

"The industry doesn't need to revisit the pain of the right-to-repair battle," Potter cautioned. "The Memorandum of Understanding (MOU) recently reached in Massachusetts goes into effect in 2018. It will enable us to avoid another conflict if we can resolve a few wording ambiguities in the MOU and establish a common, universal acceptance of J2534 v5.00. In addition, completing the J2534-3 and J2534-4 components, with industrywide stakeholder participation, will help harmonize diagnostics and software reprogramming."

"We may or may not have a single industrywide J2534 programming solution in five years, but we will hopefully be closer to tightening the

variances in the marketplace that exist today," Bosch's Carr added. "We must be cognizant of the disparity in vehicle communication architectures amongst OEMs—a hardware, not software, variance—which will create anomalies as J2534 v5.00 is deployed that will have to be reconciled. We must also accept that the emergence of other new technologies and what OEMs do with them will also impact the future of J2534."

New Emerging Market Realities

When SAE first wrote the J2534 standard in 2002, and for most of the time since, the hot issues impacting the automotive landscape today were not germane to the future of J2534. That's changed.

Hacking has transitioned from the computer and entertainment industries to automobiles. Cybersecurity is an increasing necessity, especially

as telematics and connected vehicles proliferate. So much so that OEMs are aggressively pursuing control of the vehicle software and who has access to it.

"Cybersecurity is one of the biggest problems in the auto industry today," explained Jack Pokrzywa, director of cybersecurity standards at the Society of Automotive Engineers. "Automakers are working to make cars more secure, but their late start and disparate, fragmented processes have left a number of security gaps."

Pokrzywa went on to say that "the only fix is to change the entire approach to building cars—specifically, the connected bits within them—by incorporating standardized cybersecurity methodology in product development, and to find ways to use advanced technology, such as artificial intelligence, electronic handshakes and authentication, to guard against

attacks. SAE is working toward that today by drafting J2945, J3010 and J3061 and developing other new cybersecurity standards.”

In addition, some emerging technologies can more readily be securitized. They also have the potential to limit or even eliminate the need for J2534 boxes and other associated devices. At the very least, the merits of these inbound technologies have some OEMs rethinking J2534’s future.

OEMs have actively sought full control of, and access to, vehicle software. In 2015, OEMs (supported by the U.S. Dept. of Transportation, EPA, California Air Resources Board, Automobile Service Association and others) asked the U.S. Copyright Office to grant full copyright by elim-

inating all exemptions. The request was denied by the Office in October 2015, but open to reconsideration in 2018. OEMs are also currently lobby-

ing for federal legislation that would effect the same outcome (at press time, congressional hearings were underway).
“Any electronic vehicle communication interface is prone to being hacked—whether a scan tool, J2534 box, dongle or some other device,” advised Mohan Sethi, manager for Product Management & Business Development at MAHLE Service Solutions. “Few of these devices, if any, have adequate built-in cybersecurity defenses.

Automakers and J2534 device manufacturers acknowledge that full implementation of v5.00 will take some time and considerable investment.

“OEMs also view underdash J1962 connectors as another easy vector to attack and access critical vehicle data,” Sethi noted. “It may take some time before regulators allow this archaic and insecure architecture to be replaced, but they are

on their way out. OEMs are trending toward increased use of more sophisticated and secure vehicle gateways, a proven technology that improves security by controlling access to vehicle networks, control devices and data.

“Vehicle gateways have enough intelligence and security protocols

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built-in to not only discern which users get access to vehicle communication networks and data, but what level of access is granted,” said Sethi. “In other words, access by different users for different purposes is secured, tiered, limited and authorized by the automaker. In addition, unlike J1962 connectors, gateways allow multiple users to be securely connected to a vehicle simultaneously.”

Disruption Is in the Forecast

MOTOR spoke with a number of vehicle software programming and cybersecurity experts at AAPEX, SEMA and other shows and meetings during Automotive Aftermarket Industry Week 2015. In the short-term, nearly

all agreed that J2534 v5.00 will be the workhorse for vehicle software reprogramming. It’s the current standard, it works and there’s nothing else on

Access to vehicle communication networks and data by different users for different purposes is secured, tiered, limited and authorized by the automaker.

the immediate horizon that’s ready. But the long-term future of J2534 is not so certain. Here is some of what was shared:

Software reflashing and calibrations will continue to grow. Ethernet-based architectures will re-

place current vehicle communication systems within just a few years. Ethernet will allow more data to be communicated more quickly than ever before. Think of this as a larger electronic pipeline that will be capable of communicating current data and new data sourced by telematics and connected transportation systems. That opens the door to alternative reprogramming technologies.

There will be a shift in how software updates are delivered. Current methods, primarily using J2534 devices, will increasingly be delivered via over-the-air reflashing. OTA service-oriented software updates are communicated directly from automakers to vehicles, without any J2534 device or other at-risk connections being involved. Tesla already does this. BMW, Hyundai and Mercedes-Benz have begun to on a limited basis, and several other automakers are about to. The rationale: OTA updates are less expensive to develop and, because third-party vendors and devices aren’t involved, data can be more easily securitized in-house by automakers.

Control of vehicles’ software and access to it will continue to be a goal of OEMs. Carmakers told MOTOR these attempts will continue, in part because consumers generally hold automakers responsible for vehicles being able to be properly serviced. Third-party devices, tools and equipment vary, as do other resources, be it service information, training and even service competencies. That’s problematic for OEMs, their brand image and consumer experiences. Some OEMs suggested that the Secure Data Release Model, developed by the National Automotive Service Task Force (NASTF), would be a useful means of allowing secure and traceable access for automotive professionals to propri-

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etary vehicle software.

Better vehicle connectivity is needed. The J1962 connector is passé. It's archaic, insecure, limited to connecting to one user at a time and ill-suited to modern vehicle and driving environments. While current OBD II regulations require the device, the need for secure, tiered multi-user access to data has OEMs discussing alternatives.

Some OEMs are considering a back to the future strategy. If necessary, some OEMs are prepared to limit the J1962 connector to the basic mandated OBD II data. Access to all other data would be moved to some other OEM-controlled means of access, such as vehicle gateways. At the very least, limiting the J1962 connector would require J2534 v5.00 devices to connect to vehicles some other way, likely wirelessly.

One automaker and one supplier also shared, in confidence, a more encompassing future case scenario that could conceivably actually eliminate J2534 devices. The proponents also said this scenario wouldn't breach the general rule of thumb that those signing the right-to-repair MOU agreed to—namely, whatever is made available to dealers will also be made available to independent aftermarket facilities.

In this scenario, OEMs would keep most if not all vehicle data and service procedures in-house. Both dealers and independent facilities would connect wirelessly to the OEM, which would then remotely scan a vehicle and diagnose any problem(s). The service facility would be notified of any necessary parts that needed to be installed. Then the OEM would transmit any necessary software updates directly to the vehicle.

An extreme future case? Absolutely. Too far-fetched? I don't think so, given that it's being considered, perhaps by more than the two sources who dared to share it. J2534 has been

under development for nearly 15 years. It's now being confronted by "future creep." Technology advanced over the years it took to get to v5.00. Alternative reprogramming solutions, some of which don't involve J2534 at all, are being considered by OEMs.

That's disruption for you; it puts the status quo on notice that nothing but change is certain. **M**

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