K-DCP Aftersales Suite

Innovative, disruptive changes are being driven by Autonomous, Electrified, Connected and Shared mobility trends in the automotive eco-system. These changes will require fresh thinking around the aftersales servicing/repair and dealer experiences. Evolving vehicle architectures, increasingly complex vehicle features, customer demands, and changing business models are underpinning the need for advanced aftersales service solutions, that accelerate overall profitability, reduce vehicle down-time and maximize customer loyalty/retention throughout your dealer network.

KPIT with its extensive and rich expertise in aftersales diagnostic and repair solutions, specifically for OEM dealer networks, has developed its Next-Generation Aftersales Suite to match demands today and into the future. This platform enables dealerships to perform a host of activities ranging from basic tasks such as fault reading, through to advanced processes like intelligent, augmented diagnostics and root cause repair.

K-DCP Aftersales Suite

The K-DCP Aftersales suite leverages the Service Tester, Trace2Fix (our intelligent assisted-diagnostics solution) and Business Integration solutions to deliver productivity seamlessly across multiple channels such as desktop, mobile, cloud and in-vehicle, whilst catering to both at-vehicle and connected application use-cases.

The built-in assisted troubleshooting functionality empowers service engineers to make conclusions from fault patterns and/or symptoms regardless of vehicle location. The solution tracks the most critical aftersales metrics i.e. Fix-First-Visit (FFV) and Repair turnaround time.
The K-DCP Aftersales suite drives 30% faster diagnostics, whilst improving service technician productivity by up to 40%.

The salient aspects of the platform that enable these enhancements are outlined below:

<table>
<thead>
<tr>
<th>Process improvements</th>
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<tr>
<td><strong>Built-in Intelligent diagnostics &amp; root cause analysis capability (Trace2Fix)</strong></td>
</tr>
<tr>
<td>• Assists technicians to the most probable cause, and the most optimum repair action</td>
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<tr>
<td>• Leverages machine-learning technologies to continually optimize diagnostics based on field data</td>
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<table>
<thead>
<tr>
<th>Improves technician’s efficiency and effectiveness (Service Tester)</th>
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<tbody>
<tr>
<td>• Through UI/UX expert design and insights from end customers</td>
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<tr>
<td>• By performing automated vehicle scan and life-cycle change tracking</td>
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<td>• By providing diagnostic functions through guided wizards</td>
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<thead>
<tr>
<th>Integrated toolchain</th>
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<tr>
<td>• Backend IT Infrastructure links for updates and user access mgmt., ensuring latest and greatest Software in the field</td>
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<tr>
<td>• Dependency and flash file management ensures that the software update plans are fault-proof</td>
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<tr>
<th>Faster Time-to-market</th>
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<tr>
<td><strong>Data Re-use across Engineering, Manufacturing and Aftersales</strong></td>
</tr>
<tr>
<td>• ODX data and all OTX basic library functions are 100% reusable</td>
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<tr>
<td>• Data driven approach - Enables update of diagnostic sequences without changing source code</td>
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<tr>
<td>• Supports all key and industry specific diagnostic protocols</td>
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<table>
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<tr>
<th>Build once, run anywhere</th>
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<tr>
<td>• TArchitected to run in numerous scenarios, with full support for Cloud, Offline (PC) and mobile device deployment (for Service Tester components)</td>
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<tr>
<th>Extensible</th>
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<tr>
<td>• Enables fast custom feature development and rapid time to market</td>
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<tr>
<td>• Easily adapted to customer UX needs to maximize user adoption rates</td>
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Customer satisfaction in aftersales is critical to continued brand loyalty. Whether the customer is simply undertaking a scheduled service, or has a fault that requires repair, speed and efficiency are vital. Maximized technician efficiency and reduced vehicle downtime are key enablers for a satisfied customer and an improved dealer experience.

**Purpose**
KPIT’s K-DCP Service Tester is an essential tool for supporting the aftersales/service usage diagnostic functions throughout the vehicle. It provides a flexible framework that can be used right out-of-the-box with its data driven approach that covers all the usual use-cases [software update, etc.], or customized to meet the needs of your organization.

**Users**
- Service Technicians [on-premises/field]
- Technical Helpdesk

**Input**
ODX Data and OTX Sequences

**Output**
Vehicle diagnostics and repair procedures

**Key Benefits**
KPIT’s Service Tester is a fully integrated solution that enables your organization to rapidly deploy a modern, data-driven experience to aftersales teams that:
- Enhances service technician productivity and the dealership servicing throughput
- Enables faster development of new features, thereby improving the OEMs’ time-to-market
- Significantly reduces tool maintenance costs for OEMs
- Is designed by UI/UX experts to focus on improving the dealer experience

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**Designed for Productivity –**
The K-DCP Service Tester is designed to meet the demands of a modern dealer network. Its primary focus is usability, with a simple interface that helps the user quickly adapt to the tool with minimal training effort.

With its single source and multi-platform design, updates are delivered seamlessly across all channels with minimal effort meaning that whether accessed via cloud, mobile or PC, the service tester experience is truly consistent across any delivery channel.
The service tester leverages standards based OTX sequences to deliver functionality that you would expect in the aftersales environment. Simple functions such as reading/clearing fault codes, performing vehicle health check, and software updates or complex OEM-specific diagnostic applications that can trivially interact with the user through the OTX HMI layer.

For more complex situations, KPIT’s innovative Trace2Fix solution steps in and provides assisted diagnostics that leverage vehicle data to provide precision root-cause troubleshooting.

Combining usability with the powerful ‘Vehicle Interface’ abstracts the connection to the vehicle. This enables at-vehicle and connected/remote use-cases that embrace the “work anywhere” philosophy that allows fresh thinking about technician and workshop resource utilization

**Data Driven** – Whilst productivity may be the focus, leveraging a data-driven approach significantly improves the time to market and lowers organizational burden when managing existing platforms or introducing new. The tester is fully integrated with the K-DCP Business Integration Platform to ensure seamless data management and built-in update functionality. Combined with data flow from your organization the service tester can provide automatic software update alerts and show lineage and orchestrated/combined ECU update requirements.

**Out-of-the-box simplicity, flexible extensibility** – Intuitive deployment systems ensure that the service tester can be up and running in a matter of minutes. KPIT, however, understand that your organization may have OEM specific requirements. To this end, the Service Tester is designed with flexibility in mind. Its comprehensive frameworks ensure that every use-case from simple branding through to custom features, applications or embedding is catered for with minimal effort.

**Integrated Solution** – The Service Tester is perfectly at home operating offline. But where connectivity is available, it makes extensive use of the K-DCP Business Integration Platform to improve efficiency. It can automatically pull down required diagnostic data for vehicle variants on-demand, eliminating the need for large data packages or lengthy updates.
For existing data packages, transparent [background] updates intelligently transfer size-optimized payloads to minimize the impact on dealer networks and ensure maximum flexibility over varying levels of connectivity.

Diagnostic sessions can also be captured and automatically uploaded and stored for later analysis. These sessions can also be leveraged by Trace2Fix to provide further data evidence for its machine-learning based ‘learning loop’

### Salient Features

| Data driven architecture (ODX/OTX) | Multiple **delivery channels** - cloud based, offline, PC based, mobile | Supports **standard** (UDS on CAN, UDS on IP, J1939) and OEM proprietary protocols |
| Supports **multiple VCI specifications** like J2534, RP1210 and D-PDU based VCI | Interfaces to support **integration with OEMs IT ecosystem** (Service Info, Parts Repository etc.) | **Customizable UI** enables rapid alignment for an OEM ‘branded’ look/feel |
| Seamless integration with Trace2Fix for a **complete assisted diagnostic experience** | Full integration with Business integration platform provides **up-to-date centralized data access** | **Vehicle interface** abstracts communication allowing at-vehicle, remote/connected use-cases |
The sustained drive for electrification and autonomy of vehicles, coupled with modern engineering approaches such as feature-based architectures, virtual ECUs, etc. are forever increasing the complexity of diagnosing non-trivial faults.

Modern thinking around diagnostic design will ease this burden, but at the customer interface competency and productivity are vital components. Avoiding high warranty costs based on No Trouble Found (NTF) instances, lowering Fixed-First-Visit (FFV) rates, reducing vehicle downtimes and improving technician productivity are all key metrics that are closely monitored - ultimately, these have a cumulative impact on dealer experience, customer satisfaction, retention and loyalty.

KPIT’s Trace2Fix solution addresses all these factors and provides a modern, robust, cloud-based solution that improves diagnostic outcomes, lowers technician skill gaps, and increases productivity.
Network-based diagnostics – The Network based concept of Trace2Fix encapsulates the idea that models are built to represent the digital twin of the vehicle, and information from the real vehicle is fed into the model on a continual basis. Leveraging this model enables assisted fault disambiguation and rapid diagnosis with pin-point accuracy based on self-learning & Root Cause Analysis (RCA) principles.

A dynamic model provides for far more accurate approach to guided diagnostics, compared to static diagnosis, which relies solely on pre-determined information and hence is only as accurate as the underlying information.

A Reasoning engine based on Artificial Intelligence (supervised learning) sits at the heart of the Trace2Fix solution. This engine is adept at reasoning multiple evidences, correlating fault codes, checking interdependencies, detecting ambiguities and absent fault codes, and eventually guiding the technicians to perform the most optimal troubleshooting steps to address the root cause of the manifested fault.

Continual Learning and Improvement – The most important aspect of a successful assistive system is its ability to react to change. There are many factors that can influence diagnostic steps and outcomes, for example the environment, field data and technician experience. Harnessing these valuable inputs and responding dynamically ensures that the model is continually tweaked to optimize existing diagnosis flows and identify and resolve previously unknown field-driven issues.

Trace2Fix learns from field sessions and produces recommendations for system engineers that will optimize the diagnosis flow, based on available evidence the engineer can then accept or reject the recommendation. Each action is then used as further learning evidence to tune the recommendations accordingly.

Optimized for Productivity – As you would expect, all aspects of the Trace2Fix experience are specifically engineered with productivity in mind. Your organization can choose to integrate existing tooling directly via our sophisticated API or leverage the out-of-the-box user interface that has been designed from the ground up to focus the technician on the diagnostic process.
Trace2Fix recognizes that technicians and organizations work in different ways, it provides a switch between assisted (step-by-step) and expert (test choice) modes that streamlines the diagnosis around the technician. Your organization can choose to apply a mode to specific users (based on training and experience) or allow freedom of choice accordingly.

Practical experience with existing customers has shown that Trace2Fix can diagnosis complex electrical and mechanical issues in significantly fewer steps compared to a service manual procedure. One such example reduced the troubleshooting process from 7 steps to just 2!

**Always Connected** – There is no secret that connected mobility is a great enabler for new use-cases in the automotive world. Trace2Fix is ready for this change and can support both at-vehicle and remote scenarios through its innovative vehicle interface that seamlessly blends connected and wireless connection methods with a digital twin repository. This versatile approach to connectivity, combined with the K-DCP Service Tester enables locational freedom and fresh thinking about vehicle diagnostics that no longer need to be coupled with valuable ramp space.

Furthermore, the vehicle interface enables remote diagnostic and [limited] repair operations to be carried out by call-center or service helpdesk operatives. This maximizes the flexibility of your organization to adapt the customer experience to the most cost-effective but efficient resolution path.

**Fully Integrated** – As you would expect from all KPIT solutions, Trace2Fix heavily leverages system integration to achieve fluid productivity.

- **Model Inputs** – A strong model leads to better outcomes faster, so Trace2Fix leverages the power of KPITs Business Integration Platform to enable automated data import from multiple sources across your organization (engineering data, service literature, etc.). Specially developed learning-parsers minimize the need for complete format-specific customizations, with the intelligent parts repository ensuring that common components are re-used across platforms.

- **Vehicle Interface** – The innovative vehicle interface abstraction ensures that Trace2Fix can be front-and-center in the diagnostics process, whether the vehicle is physically connected, remotely-connected or even in a different location.

- **System Integration** – By leveraging the K-DCP Business Integration Platform, Trace2Fix can seamlessly import data for model inputs, and export with up-stream systems such as Warranty. Typical usage scenarios, such as call-center operative trigger (for vehicle fault resolution) are easily enabled.

**Salient Features**

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<thead>
<tr>
<th>Fast and accurate diagnostics - based on a rich set of data – service info. engineering docs etc</th>
<th>Simultaneous reasoning adapts to additional layers of input and reduces root-cause-analysis steps</th>
<th>Assisted and Expert modes to match technician skill and experience</th>
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<tbody>
<tr>
<td>Product Agnostic - Reusable across multiple vehicle networks</td>
<td>Fully dynamic solution with articulation of probabilities</td>
<td>Strong API support supports both in-house integration and stand-alone UI use-cases</td>
</tr>
<tr>
<td>Integration of media content from OEMs at the specific test step</td>
<td>Supports at-vehicle and remote/connected use-cases</td>
<td>Vehicle interface abstracts communication allowing at-vehicle, remote/connected or call-center use-cases</td>
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The aftersales eco-system is ultimately responsible for the interface with the customer for diagnosis and repair. Wide and varying demands from vehicle platforms require the organization to develop and continually manage applications that satisfy the current and future diagnostic needs of service technicians.

Designed specifically for the aftersales/service environment, the OTX Authoring Suite [Guided] leverages the core strengths of the platform (powerful script-based development and graphical flow authoring) to deliver a platform that meets these needs whilst focusing on usability.

**Assisted Diagnostics** – The simplistic drag-and-drop and connect concepts of the diagnostics flow builder ensure that the user is clearly focused on the development of the diagnostic itself. The interface is simple to use, but behind the scenes all the underlying sequences are auto generated. There is no need to understand or write any OTX sequences!
**Wizard-based Authoring** – The authoring suite also provides library functionality to allow authors to select from previously defined templates, such as screens. Library functions combined with integral ‘wizards’ allow authors to rapidly assemble meaningful sequences from previously defined screen and sequence building-blocks. From an end-user perspective this improves adoption rates as screens has consistent, fixed look-and-feel and sequences behave in the same way. From an authoring perspective, this reduces the human cost of authoring, promotes consistency and allows faster sequence development - ultimately bringing maintenance control to your organization.

**Screen Builder** – A fully-featured WYSIWYG, drag-and-drop, technology-agnostic screen builder with all the widgets that you would expect. This functionality enables simple design and flexible deployment and is complimented by a powerful code generator that makes binding your sequence data into screen elements a snap!

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**Salient Features**

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<tr>
<th>Feature</th>
<th>Description</th>
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<tr>
<td><strong>Full support for ISO-13209 OTX standards</strong></td>
<td>(including ASAM Extensions and subsequent ISO addendum)</td>
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<tr>
<td><strong>Multiple authoring modes</strong></td>
<td>flow, script and wizard-based</td>
</tr>
<tr>
<td><strong>WYSIWYG screen</strong></td>
<td>layout with automatic binding and logic code generation</td>
</tr>
<tr>
<td><strong>Out-of-the-box, extensible SCM support</strong></td>
<td>(e.g. Git)</td>
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<tr>
<td><strong>Out-of-the-box, extensible, workflow integration</strong></td>
<td>(e.g. JIRA)</td>
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<tr>
<td><strong>Integrated diagnostic services</strong></td>
<td>browser with drag-and-drop</td>
</tr>
<tr>
<td><strong>OTX template libraries support</strong></td>
<td>with drag-and-drop screen flow orchestration</td>
</tr>
<tr>
<td><strong>Integrated OTX checker, execution and debugging functionality</strong></td>
<td>(OTX Standard and customer specific checker rules)</td>
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<tr>
<td><strong>Built-in translation support</strong></td>
<td>to simplify multi-lingual sequence development</td>
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<tr>
<td><strong>Publication module builds sequence packages for offline or down-stream testing</strong></td>
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KPIT’s Business Integration Platform is designed to provide the ‘glue’ that unifies the aftersales diagnostic delivery and vehicle-state management worlds. It follows Enterprise integration methodologies, with industry specifications like REST HAL, OPEN API, etc. to expose diagnostic data services within the diagnostic data development process.

KPIT tools are integrated out-of-the-box, and authorized external applications can easily be added through simple integration interfaces. This approach also allows for the creation of custom adapters to integrate with systems which would send data to the Business Integration Platform, which is then eventually made available to downstream applications.

**Purpose**
A unified platform that provides a cohesive end-to-end data flow across K-DCP Tools and OEM systems to harmonize the aftersales delivery and management experience. It leverages standard enterprise methodologies to ease data transition between departments and truly provide a joined-up, single diagnostics delivery platform.

**Users**
- Diagnostic Engineers
- Central Diagnostic delivery teams
- Programme and delivery managers

**Input**
Cross-department data feeds, diagnostic data (ODX, OTX), ECU software/dependencies

**Output**
‘Single-source’ enterprise-wide content artifacts and managed delivery
Vehicle state recording (including digital-twin interface)

**Key Benefits**
KPIT’s Business Integration Platform joins the dots between processes and tools, and:
- Provides a backbone for truly centralized diagnostic data content delivery
- Enables rapid platform adoption with out-of-the-box tooling integration
- Uses enterprise integration patterns to lower cost and accelerate IT-backend cohesion
- Provides digital vehicle update records for advanced use-cases such as predictive analysis
Is deployable on cloud-based and in-house infrastructure

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**Existing IT landscape / Customer applications**
- XIRA
- SAP
- Salesforce

**Business integration platform**
- Ex VE data
- Dependency management
- ODX manager
- OTX manager
- Continuous integration
- API

**Diagnostics is modeled like a standard development process:**
- Develop -> Commit
- Compile
- Test
- Release

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Secure Access – In a world with an ever-increasing burden of information-privacy and security-related threats, a “secure-by-design” ethos is a critical factor in any system that manages sensitive information. KPIT provides out-of-the-box authentication (compatible with your existing infrastructure via SAML) and fine-grained access control of data artifacts across its entire toolchain. This is a significant advantage of disparate tools and systems all requiring their own unique customizations. Additionally, Integrated licensing management through KPIT’s LIMAS ensures that your organization is always compliant with license agreements.

Diagnostics Data Content Repository – A [version-controlled] single system of record is vital for all data that is utilized by the diagnostic execution process. This is integrated with all the K-DCP tools and includes storage of ODX data and OTX sequences as well as any additional, customer-specific artifacts – such as ECU flash binary images.

Dependency Management – Efficient data storage requires strong dependency management that tracks usages and dependencies to optimize delivery efficiency. Data artifacts (ODX, OTX, manuals, etc.) are linked with their release versions enabling update recommendations and efficient data packages for service-tester consumption. Furthermore, an extensive flash and calibration dependency management system allows your organization to integrate up-stream systems to feed [or manually define] hardware and software version combinations to build software update lineage. The system can determine orchestration plans that can be leveraged at update time to ensure feature-based or multi-ECU based updates are correctly applied.

Digital Life-cycle Management – In an increasingly automated world where data-driven intelligence drives business decisions, information is key. KPIT meets this need with a fit-for-future ‘digital-twin’ solution that captures vehicle data from manufacturing to end-of-life. It provides automated data-feed capabilities and an intuitive interface for data visualization.

Operations executed through the service tester can compare vehicle model and actual read data to identify out-of-band changes to the vehicle state. Updates can be directly reflected into the vehicle model (such as software updates), equally Trace2Fix can leverage vehicle model data as an evidence source when evaluating a fault scenario.

The advantages of a valid-in-time vehicle model for entire vehicle fleets are unbounded. They range from acting as a stable base data source for an Extended Vehicle (ExVe Standard) through to advanced machine-learning based algorithms for predictive analysis.

Dashboards & Analytics – In-built dashboards provide management oversight that ensures your organization is firmly in control and able to rapidly zero-in on in-field issues. Data analytics provide detailed usage statistics and identify attention hotspots (for example emerging or recurrent diagnostic failures).

Salient Features

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<tbody>
<tr>
<td>Cloud-based, single point of integration &amp; interface</td>
<td>to existing IT back-end systems, infrastructure and diagnostic systems</td>
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<tr>
<td>Industry-specification (HAL, etc.) friendly RESTful APIs that minimize integration effort</td>
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<tr>
<td>Authentication, authorization &amp; licensing platform that integrates directly with existing providers via SAML</td>
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<tr>
<td>Single record-of-truth, version-controlled diagnostic artifact repository</td>
<td>Integral content usage and dependency tracking</td>
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<tr>
<td>Digital-twin vehicle model that captures vehicle state changes from assembly onwards</td>
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<tr>
<td>Intuitive publication and [dependency based] packaging for delivery to aftersales/service tooling</td>
<td>Dashboards and analytics that provide deep insight into diagnostic usage and success rates</td>
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<tr>
<td>Diagnostic session upload, storage and data-processing platform for deep analytics</td>
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</table>
Dealer experience and quality tooling are vital to the effectiveness of your organization whilst predicting and reacting to customer needs in the field. The underpinning of this effectiveness during the diagnostics and repair process is quality data (effectively managed ECU data, and well-maintained diagnostic sequences are just a few examples).

KPIT believes that quality is an on-going metric that should be continually monitored and improved over time. To that effect, it has developed tools and techniques that [in partnership with our customers] provide validation and provability of effectiveness before field deployment.
Automated Model Validation – The KPIT Integrated Testing Environment [KITE] is designed to meet the challenges of testing in the automotive eco-system and adapts to customer needs, providing application, device and vehicle under test functionality. It has a powerful cloud-based portal that enables faster test-case creation and combined with ‘virtual-testing’ can provide model and implementation certainty at multiple stages of the development process. This improves change management agility and lowers time-to-market for new and updated features.

Dynamic Vehicle Simulation – One of the biggest challenges facing the aftersales eco-system is quality over time. The ability to validate that diagnostic sequences for current, but older model/year platforms still function correctly when changes are made is problematic. Vehicles may not be available, knowledge may be lost. There are multiple issues that can cause defects to be introduced that encourage workarounds and discourage re-use, lowering quality.

Regression testing is vital to prevent such issues. It enables your organization to confidently make changes to shared sequences, knowing that their effectiveness can be proven before the field. KPIT leverages commodity hardware solutions to provide vehicle simulation as part of an automated test system that re-uses your diagnostic data [via auto-generation], development and field data captures and provides the ability to inject positive and error test cases.