K-DCP Engineering Toolchain Booklet

K-DCP: KPIT’s Diagnostic & Connectivity Platform
In today’s world, our customers face a landscape of increasing technical complexity, rigorous legislation varying across geographies, combined with legacy platforms and lengthy vehicle support cycles.

This landscape should be matched with a ‘ready to use’, integrated solution that meets these challenges head on. KPIT’s solution emphasizes an end-to-end, standards based ethos that improves organizational efficiency, increases data quality and meets legislation requirements with minimal effort.

The K-DCP Engineering toolchain is such an integrated tool-chain which caters to all diagnostic engineering use-cases and processes across the OE vehicle development flow.

The toolchain has been designed to embrace and leverage the benefits of data re-usability, transparency and uniformity throughout the development process. It encompasses tools that enable the OEM system and component engineers to seamlessly execute activities such as:

- Diagnostic data specification development
- ECU diagnostic data authoring
- Development of test sequences for ECU validation
- Execution of ECU sequence and conformance tests

A cloud-based enterprise integration platform joins all the engineering functions together, connecting the dots from requirements sign-off through to automated compliance gateways; automating data flow and eliminating legacy processes (such as manual file handling).

Integrated dashboards provide up-to-the-minute insight into development maturity and place our customers firmly in control of their diagnostic artifact delivery.
Value Proposition

As an integrated set-up, the Engineering toolchain enables significant reduction in authoring efforts, whilst delivering improved and consistent data quality.

The salient aspects of the toolchain that enable >30% reduction in authoring efforts (when compared to tool-chains existing in the market today) are outlined below:

<table>
<thead>
<tr>
<th>Process improvements</th>
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<tbody>
<tr>
<td><strong>Integrated tool-chain</strong></td>
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<tr>
<td>• Data re-use across the product lifecycle and across all participants including OEM Suppliers</td>
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<tr>
<td>• Process workflows - ensure user roles have access to relevant and appropriate information</td>
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<td>• Traceability enhancements through complete integration with OE IT systems</td>
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<tr>
<td>• Simplified authoring process through new ODX and OTX tooling</td>
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<tr>
<th>Fully tool driven development</th>
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<td>• Information is stored centrally and not stored in local files (e.g. Spreadsheets, ...)</td>
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<td>• Data flow is managed automatically - no manual file transfer from one tool/process step to another one</td>
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<tr>
<th>Single source of truth</th>
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<td>• Data is version-controlled, ownership is maintained at the OE end and built-in verification steps ensure quality</td>
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<tr>
<td>• Import existing content from upstream systems (e.g. design phase outputs), and exporting to downstream systems (e.g. DEXT [Autosar Configuration])</td>
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<tr>
<th>Bullet proofing diagnostic functionalities</th>
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<tr>
<td>• ODX data and OTX libraries are re-used across the engineering toolchain, and then published to downstream consumers (e.g. Manufacturing and Aftersales) improving consistency and lowering bug counts</td>
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<tr>
<th>Validation improvements</th>
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<tr>
<td><strong>Automated Validation of data and ECUs</strong></td>
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<tr>
<td>• Enable left-shifting (early) validation of ECU hardware/software against diagnostic data</td>
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<tr>
<td>• Validation tool to validate ECUs and ODX/OTX, against specifications &amp; requirements</td>
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<th>Engagement</th>
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<td><strong>Current State/Migration</strong></td>
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<tr>
<td>• A comprehensive data landscape audit is undertaken to capture existing data availability</td>
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<td>• As is process is evaluated and understood to ensure pain-points are captured and resolved in target-state platform</td>
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<tr>
<td>• A data migration strategy is formed in partnership with the customer to ensure that existing investment is maintained and leveraged as a kick-start of the transformation</td>
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<th>Execution/Roll-out/Training</th>
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<td>• Flexible team resourcing ensures a smooth ramp up. This minimizes delivery risk and maximizes delivery throughput</td>
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<td>• Initial roll-out is critical to the success of an engagement, KPIT recognizes this and has a hyper-care phase that provides enhanced support, on-site resource and rapid resolution during this critical time</td>
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<td>• Comprehensive training programs are standard as part of the roll-out process and are designed to effectively educate tool and process users ready for a rapid adoption</td>
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K-DCP Database Designer (DBD) | Product Overview

**Purpose**
The Database Designer offers a comfortable working environment for diagnostic functional specification of all the ECUs within a vehicle. Users can create standards compliant ODX data for OEM and supplier industries.

**Users**
- Diagnostic Architects
- System Engineers

**Input**
ECU specifications and guidelines

**Output**
Diagnostic data (ODX) which is further leveraged by downstream tools (ECU Editor, ECU Validator and OTX Authoring Suite) or downstream customers directly

**Key Benefits**
The Database Designer is a fully featured tool and an essential part of a diagnostic tool chain that:
- Enables rapid, scalable, data visualization and manipulation across the entire ODX data-set
- Ensures quality output through structured editing and compliance validation

Effective data management is a critical element of a successful diagnostic solution. KPIT understands that regardless of data volume (single ECU, system or entire platform), an effective tool is required that can enable rapid visualization, understanding and data modification.

The Database Designer is the perfect solution. It provides standards compliant, drag-and-drop, element-by-element ODX (or PDX) manipulation capabilities without the need for any intermediate import/export. This ensures simplified and accelerated data processing throughout the entire diagnostic development process.

**Salient Features**

<table>
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<th>Feature</th>
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<tr>
<td>Dynamic data management easily scales from a single ECU to entire vehicle data sets</td>
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<tr>
<td>Fully <strong>standards-compliant</strong> (up to ODX 2.2.0) native support</td>
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<tr>
<td>Complete ODX element <strong>visualization and manipulation</strong> functionality</td>
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<tr>
<td>Integrated, extensible checker tool ensures <strong>ASAM standards</strong> and customer-specific rule <strong>compliance</strong></td>
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<tr>
<td><strong>Integrated PDF generation</strong> enables seamless creation of complete ECU function manuals</td>
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<tr>
<td><strong>Integrated</strong> Excel import and export features</td>
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As vehicle systems evolve and electrical complexity increases, it is essential that diagnostic data authoring keeps pace. The product development cycle is facing growing pressures from tightly-controlled programme timelines, multiple design inputs (such as architecture, diagnostic requirements and FMEA) and a continuing trend towards service-oriented, function-based systems. All these aspects provide challenges that require fresh thinking over traditional methods.

The ECU Editor meets this challenge head-on. It is a diagnostic function data authoring platform that is designed from the ground-up to promote efficiency and productivity through use-case focused features that actively re-use existing authoring effort.
**Single Solution, end-to-end Focus** – Business inputs drive the diagnostic function authoring, so the ECU Editor provides comprehensive support features that allow your organization to leverage and re-use these inputs as the basis for the data authoring process. Of equal importance, however, is the understanding, and delivery of matured diagnostic data. The ECU Editor provides built-in dashboarding, validation and maturity checks that ensure quality downstream delivery.

**Collaborative Authoring** – The key to achieving improved productivity and achieving a left-shift in this end-to-end process is collaboration. The ECU Editor is fully integrated with K-DCP’s cloud-based integration layer which seamlessly handles rapid, concurrent manipulation that removes the challenges faced by traditional file-based approaches.

Fully configurable access control functionality secures and expands collaboration into supplier base whilst ensuring adequate IP protection is in place. This is a clear advantage. Working together as teams and across organizations lowers the authoring cost and improves data quality.

Imagine a scenario where:

- **OEMs** – Define requirements for, integrate and validate data from suppliers in a central repository. Monitor, finalize and release packages to downstream consumers. (Engineering tester, OTX sequence authoring, ECU validation, manufacturing EoL, and Service tester)
- **Suppliers** – Integrate diagnostic requirements from OEMs, author ECU data and release for testing and validation by the OEM.

**Import/Export** - As much as quality and control are critical within the authoring process itself, effortless integration of input and output systems within the organization is also crucial. The ECU Editor has an extensible import/export framework that adapts to your organizational needs.

Import automatically handles diagnostic design input formats (such as electrical architectures from Vector PREEvision, or data from CANdela- and ODXStudio).

Export provides seamless baselining and publication processes, ensuring clear traceability and understanding of what was delivered and when. Of course, this includes standards-compliant ODX-based and DEXT output, but multiple output formats are supported to meet your organizational and legacy needs.

**Salient Features**

<table>
<thead>
<tr>
<th>Dynamic data management</th>
<th>Fully <strong>standards-compliant</strong> (up to ODX 2.2.0) native support</th>
<th><strong>Collaborative</strong> authoring accelerates delivery through concurrent (single or multi-ECU) working</th>
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<tbody>
<tr>
<td>easily scales from a single ECU to entire vehicle data sets</td>
<td>Function specific <strong>visualization</strong> and <strong>manipulation</strong> for DTCs, data monitoring, routine controls etc</td>
<td>Integrated, extensible checker tool ensures <strong>standards</strong> and <strong>customer-specific rule compliance</strong></td>
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<tr>
<td>User experience <strong>optimized</strong> for productivity with wizards for easy and effective authoring</td>
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<tr>
<td><strong>Out-of-the-box support</strong> for service-oriented, function-based guided data authoring</td>
<td><strong>Integrated import/export</strong> features, including ODX, DEXT, RIF (IBM Doors), PREEvision, CANdela (Vector) etc</td>
<td><strong>Support for multilingual</strong> diagnostic data</td>
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KPIT understands that whether the organization is large or small, diagnostic engineers should be focusing on the development of relevant diagnostics applications and functions.

To that effect, KPIT has re-imagined the diagnostic authoring process and provides a fully-integrated, feature-rich, productivity-focused authoring suite that truly meets the modern authoring needs. The suite delivers use-case specific functionality such as:

Key Benefits
KPIT’s OTX Authoring Suite increases productivity by fundamentally re-thinking the approach to diagnostic sequence authoring and presenting a fresh approach that:

- Enables authoring of standardized, reusable and exchangeable diagnostic sequences
- Provides an intuitive user experience to maximize efficiency
- Provides role-specific views on sequence authoring to minimize effort
- Offers the opportunity to leverage modern development processes as part of an overall diagnostic sequence authoring strategy

Purpose
KPIT’s OTX Authoring Suite (AS) is a re-imagination of OTX authoring that focusses on simplifying the overall authoring experience, whilst understanding and optimizing the productivity of different user groups.

Users
- System Engineers & Component Engineers
- Service/Manufacturing Technicians
- ECU Suppliers

Input
ODX data and diagnostic application/function specification documents

Output
OTX libraries, screens and sequences ready for down-stream consumption and execution
**Script Editor** – The ‘Script editor’ provides a fully-featured editing experience. A power user can develop and debug sequences significantly faster than graphical methods. This simplicity, however, does not compromise ease-of-use, and authors can leverage the smart auto-complete functionality of the editor to avoid unnecessary context switching. Authors can seamlessly switch between script and flow views at any time to best suit their development needs.

This IDE-style development environment is underpinned by an enterprise-ready platform and provides all the capabilities that you would expect from a powerful development environment, including an integrated OTX execution/debugging environment.

**Flow Editor** – An innovative view on the diagnostic sequence editor’ designed with the diagnostic engineer in mind. It provides a simplified interface that allows a diagnostic [specification] flow to be built, whilst avoiding the need to understand the underlying, technically complex OTX details.

**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!

**Salient Features**

- **Full support for ISO-13209** (including ASAM Extensions and subsequent ISO addendum) OTX standards
- **Multiple authoring modes**, flow, script and wizard-based
- **WYSIWYG** screen layout with automatic binding and logic code generation
- **Out-of-the-box, extensible SCM support** (Git)
- **Out-of-the-box, extensible, workflow integration** (JIRA)
- **Integrated diagnostic services browser** with drag-and-drop
- **OTX template libraries support** with drag-and-drop screen flow orchestration
- **Integrated OTX checker**, execution and debugging functionality (OTX & customer checker rules)
- **Built-in translation support** to simplify multi-lingual sequence development
- **Publication module** builds sequence packages for offline or down-stream testing
- **Out-of-the-box, extensible** workflow integration (JIRA)
- **Integrated diagnostic services browser** with drag-and-drop
- **Fully integrated with KPIT’s cloud repository** for seamless, change-driven sequence development
- **Built-in translation support** to simplify multilingual sequence development
Where the rubber meets the road, diagnostic design becomes reality. It is vital to have access to your prototype vehicle(s) for testing. This is where the Engineering Tester steps in. It is an essential tool for observing behavior and identifying functional defects during the diagnostic development process. It provides advanced functionality that improves engineer productivity and lowers development cost.
Data Monitoring – One of the key aspects of development is the ability to monitor behavior and determine if the expected (design) behavior is being seen in the physical prototype. Whether test-rig based, test-cage based, or on-the-road measurement, the diagnostic tester is capable of setting and capturing multiple measurement parameters and continuously monitoring these through table and graph-based visualizations. Threshold alerts can be set to quickly indicate parameters that are outside expected values.

BusExplorer – Advanced Bus monitoring capabilities provide a diagnostic-protocol based view for faster trace analysis. It features intelligent search, filters and markers that quickly locate traffic patterns and increase the productivity of diagnostic engineers through faster understanding and troubleshooting.

Diagnostic Services Examiner – The diagnostic service examiner enables rapid execution capabilities for evaluation of ECU implementation and exploration of ECU feature points (for example routine execution, fault code reading/reset, etc.) with visual feedback and result interpretation. Additionally, data points from continuously read diagnostic services can be added to watch lists or visualized for easy interpretation.

Custom Diagnostic Features – The engineering tester functionality can easily be extended to provide support for custom or complex diagnostic functions through OTX sequences. These are easily imported into the tester and can leverage HMI through OTX screens. This comprehensive extensibility provides unrivalled flexibility and minimizes downstream issues as diagnostic functions will have already been exercised and debugged.

Integrated Solution – Of course, the Engineering Tester is only as good as the diagnostic data that it has available. KPIT’s integrated solution ensures that diagnostic engineers are always utilizing the latest approved data (for example ODX). This tight integration ensures that there is no ambiguity regarding what is being tested and with which data, no more manual file transfer and access to the latest ECU software artifacts from a central location!

Salient Features

- Multi data-point monitoring, alerting and capture with tabular or graphical representation
- Advanced bus monitoring capture and analysis
- Leverages standards-based diagnostics data (ODX, OTX sequences)
- On-demand diagnostic service execution and response interpretation (Read/Modify ECU parameters, Read/Clear fault codes, etc.)
- Out-of-the-box, multi-bus support including ([FT-] CAN, DoIP, etc.)
- Portable installation base (PC, Tablet, Cloud, etc.)
- Execution through KPIT’s proven Diagnostics stack
- Full integration with Business Integration Platform provides up-to-date centralized data access
**Key Benefits**

KPIT's ECU Validator provides automated conformance and validation functionality that:

- Provides an automated quality gateway for diagnostic delivery
- Can operate at component (ECU) or feature level and leverage HIL integration
- Proves that implementations conform to stated requirements and specifications
- Provides traceability from test result to diagnostic function, and initial requirements
- Enables centralized maturity dashboards that put you in control of your deliveries

With the ECU Validator, ECU conformity certification is no longer a high-cost process, nice-to-have or an after-thought. This is now an integral part of your diagnostic data process and under your control.
**Conformance and Traceability** – The ECU Validator is specifically designed to leverage your diagnostic data to validate an ECU implementation meets the defined requirements and functions correctly. It provides deep links from test cases to specifications and gives complete traceability from the executed test, right back to the defining requirement.

**Data-Driven Testing** – Traditional testing methods have relied on hand-crafted, brittle test suites, but no more. As part of an integrated platform, you have access to your diagnostic data (ODX) and test sequences (OTX). The validation process leverages that data in conjunction with test sequences, to prove conformity at either a component level, or system level with HIL fault-injection support (if available). In addition, domain-specific sequences can easily be added that extend the test coverage as required.

Easy to understand reports provide quickly highlight any failures, identifying gaps between the given requirements, and importantly provide the symbolic and bus trace data – no more searching around in log files. Having this information readily available accelerates correction-loops with the supplier and shortens re-test cycles.

**Process Integration** – Once again, productivity is a key focus. The ECU Validator can operate stand-alone but has built-in integration with KPIT’s cloud-based Business Integration Platform that maximizes the tool’s value within the diagnostic development process.

Users select execution criteria from available data and test suites; the tool takes care of preparing the data and executing the tests automatically. Once executed, the reports are automatically generated and uploaded where the results can be centrally visualized through integrated data maturity dashboards. This closed-loop validation provides absolute clarity on stated-vs-achieved ECU implementation progress.

Your diagnostic organization now has the tools it needs to rapidly identify the cause of the failure, and where data-related can be directly reference test results in the authoring tools (such as ECU Editor) for correction.

### Salient Features

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<tr>
<th><strong>Data-driven testing</strong> that leverages diagnostic data (ODX, OTX) to validate compliance to specifications</th>
<th><strong>Support for bench-based setup</strong> with commodity interface devices, extensible to incorporate HIL fault-injection based testing</th>
<th><strong>Automated execution</strong> of positive and negative test cases</th>
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<tr>
<td><strong>Execution statistics</strong> and detailed <strong>test results</strong></td>
<td><strong>Test report generation</strong>, including executed test steps, <strong>bus &amp; symbolic traces</strong></td>
<td><strong>Easily expand test coverage</strong> for specific functions or special cases with additional OTX sequences</td>
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<tr>
<td><strong>Tests executed through KPIT’s proven diagnostics stack</strong></td>
<td><strong>Full integration with Business Integration Platform provides centralized, correct maturity data</strong></td>
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KPIT’s Business Integration (BI) | Product Overview

**Purpose**
A unified platform that provides a cohesive end-to-end data flow across K-DCP Tools to left-shift the diagnostic data development process. It leverages standard enterprise methodologies to ease data transition between departments and truly provide a joined-up, single diagnostics development platform.

*Note*- The information included herein refers to the Engineering flavor of the Business Integration platform. There are other applications of the Business Integration platform, which are covered separately in the Business Integration booklet.

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

**Input**
Cross-department data feeds, diagnostic design data, diagnostic authoring content

**Output**
O’Single-source’ enterprise-wide content artifacts and managed delivery

**Key Benefits**
KPIT’s Business Integration Platform joins the dots between processes and tools, and:
- Provides a backbone for truly centralized diagnostic data authoring and 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

KPIT’s Business Integration Platform is designed to provide the ‘glue’ that unifies the functions of the diagnostic development and delivery 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.
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 tool-chain. 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 key aspect of an integrated system is a single system of record. We provide a single version-controlled repository for all data that is generated by the diagnostic development process. This is integrated with all of the K-DCP tools and includes storage of ODX data and OTX sequences.

Dependency Management – Efficient data storage requires strong dependency management that tracks usages and dependencies to eliminate invalid data and maximize re-use. Built-in dependency tracking takes care of this. Data artifacts (ODX, OTX, manuals, etc.) are linked with their release versions. The system can ultimately provide update recommendations and data packages for down-stream consumption. Furthermore, an extensive flash and calibration dependency management system allows your organization to target specific vehicle-sets with combinations of hardware and software versions and suggest the optimal approach to update or calibrate the connected vehicle.

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 destruction. It provides automated data-feed capabilities and an intuitive interface for data visualization.

Continuous Integration – Configurable pipelines allow diagnostic data to mimic the software development process with steps such as: quality gates with continuous build, checkers, test automation, release management and publishing. These can be easily configured to implement customer-specific data quality and verification processes.

Dashboards & Analytics – In-built dashboards provide management oversight, and up-to-the-minute, status reports that ensure your organization is firmly in control and able to rapidly zero-in on development issues. Data analytics provide detailed usage statistics and identify attention hot-spots (for example program development that is not currently behind, but where the velocity and remaining work effort mean it will become late).

Salient Features

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<tr>
<th>Cloud-based, single point of integration &amp; interface to existing IT back-end systems, infrastructure and diagnostic systems</th>
<th>Industry-specification (HAL, etc) friendly RESTful APIs that minimize integration effort</th>
<th>Authentication, authorization and licensing platform that integrates directly with your existing providers via SAML</th>
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<tr>
<td>Single record-of-truth, version-controlled diagnostic content repository</td>
<td>Integral content usage and dependency tracking</td>
<td>Configurable pipelines to enable continuous integration &amp; quality gating of diagnostic data</td>
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KPIT is a global technology company with software solutions that will help mobility leapfrog towards autonomous, clean, smart and connected future. With 6000+ Automobelevers across the globe, specializing in embedded software, AI & Digital solutions, KPIT enables customers accelerate implementation of next generation mobility technologies. With development centers in Europe, USA, Japan, China, Thailand and India – KPIT works with leaders in mobility and is present where the ecosystem is transforming.

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