Network Based Advanced Diagnostics

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SMART PinPointer
Network-based advanced diagnostics

Powered by Cloud
Beyond Traditional Diagnostics

An Introduction
What would you Recommend?

**Scenario** - An unwell person is experiencing multiple symptoms.
Which of the following approaches would you recommend for this person?

**Approach A**
Symptomatic Treatment

Treat for **All possible symptoms**, simultaneously - **without knowing** the core problem

**Approach B**
Identify the Root Cause First

Identify the **Root cause** of problems experienced by the person, before **starting** to **treat the symptoms**
Accurate, Efficient and **Cost effective Diagnostics**

Simultaneous **Reasoning** with **Advanced Troubleshooter**

**Guided** Diagnostic Solution

Use of **Absent** DTCs

With **pin-pointed Root Cause Analysis** at its **core**, it provides...

**Vehicle specific** diagnostics

**Field** feedback usage

**Dynamic** Test/Repair **Ranking**
Why is a Smart Guided Troubleshooter like solution so relevant Today?
Evolution of Diagnostics

Traditional Diagnostic Problem Statements

- Design & Engineering processes are **Siloed**
- Multiple **DTC’s** relate to a single issue
- Increasing number of **complex variants**
- Low **Fix First Visit** (FFV) rates
- High number of **No Trouble Found** (NTF) cases
- Increasing **Warranty Costs**

Transitioning from Static to Dynamic Vehicle Diagnostics

- **Service Manual**
  - Traditional service diagnostics
  - Static test/repair sequences

- **Manual Diagnosis**
  - Non-model based (e.g. analytics)
  - Partly-Dynamic test/repair sequences

- **K-GRIP**
  - Network based diagnostics
  - **Fully-Dynamic** test/repair sequences
  - Continuous improvement through integrated feedback loop

- **K-GRIP++**
  - Further improvement through Learning Technologies

**Repair Time**

**Diagnosis Accuracy**
Real World Implementation of K-GRIP | A Visualization

1. John takes a long journey in the Alps. At the end of journey the service lamp is blinking and he can hear some brake noise.

2. Max, a Service Advisor connects an advanced diagnostic tool to John’s car which records the DTCs & Symptoms.

3. Lily, Service Technician runs the K-GRIP Diagnostics. It collects historical data for the vehicle and connects to the Cloud.

4. Lily gets all the required guidance from KPIT’s K-GRIP & she performs recommended tests and repairs.

5. Max, a Service Advisor connects an advanced diagnostic tool to John’s car which records the DTCs & Symptoms.

6. John is a delighted customer!!! His waiting time has been reduced significantly. His trust is increased as he knows exactly what has been done to his car.

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Assimilating knowledge... In an Integrated and a Protected Environment

- Systems Engg.
- Historical Vehicle Data
- Service Tech’s Expertise
- Field f/b

- OEM specific System Engineering Inputs
- Vehicle’s data history
- Documented repair and troubleshooting steps
- Knowledge base of successful repair solutions

K-GRIP Learning Loop

- Secure OEM/technician communication
- Helps optimize Run-time troubleshooting
- Enables capturing of tacit knowledge and making it available explicitly
- Integration with public domain knowledge to expedite troubleshooting

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Guided Diagnostics | Existing Market Solutions & KPIT’s Differentiation

- **DTC based Guided Diagnostic**
  - Dependent on technician’s expertise to follow multiple DTC test steps
  - Lengthy troubleshooting and less productive

- **Model based Guided Diagnostic**
  - Model prepared to reflect how the platform is actually engineered
  - Used in Aerospace since 90’s
  - High Accuracy Potential

- **Data Analytics based Guided Diagnostic**
  - Substantial amount of field data needed
  - System takes time to learn and be productive
  - Variant handling challenges
  - **Drawback: Ramp Up & Diagnostic Accuracy**

- **Network based Guided Diagnostic**
  - Network design enables coupling of domain knowledge and diagnostic data
  - Leverages Model based, DTC and Data Analytics based techniques
  - Determines which root causes of failure in this actual model can result in the case at hand
  - **High Accuracy & Fast Response Solution**

**K-GRIP Differentiation**

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Industry Segments

Vehicle Design
document all parts & pieces of the vehicle architecture

Vehicle Design
document all fault scenarios from DFMEA + field feedback

Technicians
Pin Point Root Causes > efficiency < req. skills

Feedback Loop
to improve network model and improve FFV & NTF ratios

Relates Parts and Claims to Symptoms/Failure Modes
Reduce Warranty costs

Use Cases

Vehicle Design document all fault scenarios from DFMEA + field feedback

Technicians Pin Point Root Causes > efficiency < req. skills

Feedback Loop to improve network model and improve FFV & NTF ratios

Relates Parts and Claims to Symptoms/Failure Modes
Reduce Warranty costs

User Scenarios

User Scenarios

Network based Advanced Diagnostics

Vehicle Design document all fault scenarios from DFMEA + field feedback

Technicians Pin Point Root Causes > efficiency < req. skills

Feedback Loop to improve network model and improve FFV & NTF ratios

Relates Parts and Claims to Symptoms/Failure Modes
Reduce Warranty costs

Engineering

Engineering

Aftersales

Warranty

Network based Advanced Diagnostics
K-GRIP Solution | Benefits

**Fast and Accurate Diagnostics**
*Based on rich set of data – Service info. Engineering docs etc.*

**Quick time to Market**
*Production ready as soon as model is developed and ever evolving*

**Product Agnostic**
*Reusable across multiple vehicle networks*

**Automated Model Development**
*Suite of automation tools for model development and validation*
### Fault Scenario

<table>
<thead>
<tr>
<th>DTC CODE</th>
<th>STATUS</th>
<th>CONSIDERED</th>
<th>FAULT CODE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0122</td>
<td>Active</td>
<td>Yes</td>
<td>INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW</td>
</tr>
<tr>
<td>P0222</td>
<td>Active</td>
<td>Yes</td>
<td>THROTTLE POSITION SENSOR 2 CIRCUIT LOW</td>
</tr>
<tr>
<td>P2135</td>
<td>Active</td>
<td>Yes</td>
<td>THROTTLE POSITION SENSOR 1/2 CORRELATION</td>
</tr>
</tbody>
</table>

**Test & Repair**

<table>
<thead>
<tr>
<th>TEST</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART: K922_Powertrain_(5.7L)</td>
<td>check for open</td>
</tr>
<tr>
<td>PART: F855_Powertrain_(5.7L)</td>
<td>check for open</td>
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</tbody>
</table>
### TEST

<table>
<thead>
<tr>
<th>PART:</th>
<th>DESCRIPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>K922_Powertrain_(5.7L)</td>
<td>check for open</td>
</tr>
<tr>
<td></td>
<td>Name: K922_Powertrain_(5.7L)</td>
</tr>
<tr>
<td></td>
<td>Ckt tracer color: DB</td>
</tr>
<tr>
<td></td>
<td>Display name: ENG - THROTTLE POS SNSR RTN</td>
</tr>
<tr>
<td></td>
<td>Ckt color: BN</td>
</tr>
</tbody>
</table>

### RESOURCES

- THROTTLE CONTROL SYSTEM - 5.7L

### REPAIR

<table>
<thead>
<tr>
<th>PART:</th>
<th>DESCRIPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>K922_Powertrain_(5.7L)</td>
<td>Repair/Replace &amp; Perform Powertrain Verification Test</td>
</tr>
<tr>
<td></td>
<td>Name: K922_Powertrain_(5.7L)</td>
</tr>
<tr>
<td></td>
<td>Ckt tracer color: DB</td>
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<td></td>
<td>Ckt color: BN</td>
</tr>
</tbody>
</table>

### RESULTS:

- Enter comments:
  - NO PROBLEM FOUND
  - OPEN
  - FIXED
  - PARTIALLY FIXED
  - DID NOT FIX
Thank you