SELF-HEALING SOFTWARE FOR CONNECTED CARS

Rudolf von Stokar, GM, Aurora Labs GmbH
Automakers moving to an agile user-centric development process

- Increased consumer engagement and development cycles

- Cross-domain, connected, SW platforms that are independent of the car platform development are the key factor for user-centric business growth

  User satisfaction, security and safety must be maintained ‘on the road’
New paradigm – Car launched and SW continues to be developed and remotely deployed

Continuous SW Development - ‘on the road’

- Exponential New features rollouts
- Customers related
- Shorter release cycles

SW Deployment before the car meets the road

SW Development Work

Time

Revolution Tesla

Audi A8

Post car launch new SW deployment is near to zero
### Opportunities and challenges across the board

<table>
<thead>
<tr>
<th>R&amp;D - Speed Up!</th>
<th>Production - Be on time!</th>
<th>Post Production - Business growth!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent SW platforms</td>
<td>• Dependencies and Infinite variations - Pushing testing to the limit</td>
<td>• Remote code maintenance – Safety and Security</td>
</tr>
<tr>
<td>• Feature roadmaps</td>
<td>• JIT programming for inventory efficiencies</td>
<td>• OTA ‘recalls’</td>
</tr>
<tr>
<td>• Uncoupling from car platform development cycles</td>
<td>• 20 minute challenge</td>
<td>• Opportunity for post-production feature sales – Monetization!</td>
</tr>
<tr>
<td>Interoperability, cross-domain services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shorter vehicle development cycles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased development iterations - prototyping</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Self-Healing Software is needed to realise opportunities and support the challenges

A Line of Code Maintenance™ Technology that gives instant feedback of code level faults, assures product uptime and functionality and seamlessly and efficiently updates any and all ECU software, at all stages of the car lifecycle

Self-Healing Software

- DETECT
- FIX
- UPDATE
Fault Detection and Downtime Prediction

Deep Learning and Machine Learning algorithms based

Recursive, ongoing and autonomous software vulnerability analysis

SW ECU drifting catcher

SW ECU deviation catcher

Root cause analysis

Line of Code resolution

Prediction of SW ECU downtown probability

“50 Errors for every 1,000 new lines of code, QA removes up to 85% of bugs and vulnerabilities”
Fault Detection and Downtime Prediction

“50 Errors for every 1,000 new lines of code, QA removes up to 85% of bugs and vulnerabilities”

Daimler recalls 3 million cars for engine ECU SW update at a cost of $250 million

Volkswagen recalls 2 million cars for engine and braking ECUs SW update

Chrysler recalls 1.3 million cars due to a SW bug disabling airbags, 1 death, 2 injuries

“GM recalls 4.3 million cars due to a SW bug that prevents airbags from deploying in a crash, 1 death, 3 injuries”

OEMs stand to lose $15B annually, 10-15% of their operational margin
Self-Healing - Fixing SW on the road

A safety net that enables continuous operability for ultimate user experience

Self-Healing: Delete and kill processes and rollback to the last safe point

Enables a hot-swap rollback to ANY of the previous versions without requiring dual memory with zero downtime
Auto Update

Clientless
No changes to bootloader
No changes to current software distribution channel
Diff files are standard bin, Intel-Hex or S-record
Diff files significantly smaller than BSdiff

Supports AutoSAR and Linux
Delta update without reprogramming the memory
Zero downtime with no need for dual memory
Supports High-performance ECUs
Qualitative Comparison of Update Alternatives

**Standard Workshop Update**
- Maximum unavailability for the user
- Total offline period

**Online Update**
- Unavailability of the vehicle for the user is significantly reduced
- Reflash time is unchanged
- Total offline period

**Differential Update**
- Transfer volume/time is significantly reduced
- Reflash time is unchanged
- E.g., Redbend, Arynga, Windriver...
- Total offline period

**Aurora Labs**
- Smallest Transfer volume/time
- Shortest Reflash time
- No flash-erase required
- Total offline period
Aurora Labs Control Center
Enabling Continuous Agile User-Centric Development

Coding > Staging > Production > Post Production
DETECT | FIX | UPDATE USE CASES AND PROJECTS

3 OEM
3 Tier-1
Total 12 departments
Total 67 uses cases
European OEM

Detect Software drifting that can decrease the engine life span - Diagnostics department
European OEM

Self-Healing Software - enabling autonomous and recursive QA, post production – ADAS team
US Tier-1

Self-Healing Software - recovery from malicious code in the body control unit – Security department
Asian Tier-1

Clientless OTA for the body control unit enabling seamless deployment over UDS protocol – OTA Update team
US OEM

Diff Update and Rollback without dual memory scaling up to all ECUs - Connectivity team
European OEM

Security key updates to door lock unit - Security maintenance - Remote services department
European OEM

Line-of-code level fault resolution in assembly line tester – Production department
European OEM

Continuous, on-the-road software management for ADAS system – ADAS team
European OEM

DIFF Update, blockchain-based trusted distribution to support multiple versions on the ECU - Online digital connectivity department
Asian Tier-1

Self-Healing from cyber attack to the body control unit by rolling back to a previous secured software version – Security department
LET’S DISCUSS YOUR USE CASES

Contact Rudolf von Stokar
+49 172 329 7385
Rudolf.Stokar@auroralabs.de
THANK YOU.

www.auroralabs.com