Android Infotainment quality analysis

By end-user behavior modeling and vehicle data

AMM Gothenburg April 2024
Introduction

Development of an infotainment system - large task

- Powerful platforms running many applications
- Dependencies on many other ECUs
- The main user interface to people in the vehicle
  -> quite a lot that can go wrong
    - laggy user interface
    - random crashes
    - ...

> quite a lot that can go wrong
Speakers

Emil Dautovic

Tero Aaltonen
“Yesterday”

Mobile phones 20 years ago

-> a lot of experience gained

Image source: Wikimedia Commons
Problems with Infotainment Systems Most Prevalent

“Among the nine major vehicle categories measured in the 2024 VDS (Vehicle Dependability Study), owners experience the most problems with their infotainment systems” - JD Powers
Problem

“I have a 2 week old [redacted]. Numerous issues with the infotainment system. Still waiting for [redacted] to provide an update to resolve stability.”

“I'm in market for a new car and I really like the [redacted], but the issues I see about Android Automotive on this and other forums are really troubling.”

“Had [redacted] for 3 months. Had 3x infotainment issues, one of which required a trip to the dealership. Android in a car - terrible idea.”

“The [redacted] now has just under 10,000 miles. The Google system is terrible.”

“Curious if other folks are seeing issues with the infotainment system rebooting. The car drives fine, but definitely a PITA. I read a lot of posts forums of similar experiences.”
Discover hard-to-find defects before your end-users do.

Our technologies and services provide a prioritized summary of software stability, performance, power consumption, and functionality levels at one sight.
Some typical findings in automotive infotainment systems

Memory leaks
A SW component leaking memory will lead to system instability and crashes in the long run.
Such defects often go unnoticed in OEM QA processes but are the most common defect type we discover during the analysis.

Suspend-to-RAM and resuming
Resuming system state is complex and its implementation lays low in the SW stack, often provided by the chipset vendor.
STR issues may lead e.g. to Bluetooth connectivity problems which are extremely difficult to debug.

UI performance
Stability problems don’t always manifest as crashes.
Sometimes, they lead to an ever-slowing-down system that is still functionally ok but unpleasant to use.

Random crashes outside the infotainment domain
Some defects occur only under specific, sometimes rare circumstances.
Root cause might not be in infotainment, but e.g. at a hypervisor level, or in some of the interconnected entities.
Stability Analysis System Architecture

Main analysis / user modeling

Lab client

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Stability Analysis System Architecture

User behaviour models

- Navigation
  - Set destination, navigate there, ...
- Multimedia
  - Music player
  - Radio
- Phone calls
  - Originating (from various parts of the UI)
  - Receiving
- Bluetooth
  - Connecting / disconnecting phones
  - Receiving an audio stream over BT
- Voice control / assistant
- In-cabin settings
  - HVAC, ...
Stability Analysis System Architecture

Quality Analytics Backend

- Data synchronization, issue detection, and root cause analysis
- Dashboard for product management, QA, and engineering teams:
  - Quality trends: are things getting better or worse?
  - What are the most critical issues?
  - How likely are they to happen, and when?
  - What’s their impact on end-users?
  - What are their root causes?
Stability Analysis System Architecture

- QNX/Hypervisor
- ECUs, telematics, etc.

Main analysis / user modeling

Log fetching, data collection, etc.

Any module with any external interface: serial, SSH, ADB, etc.

Lab client

Quality Analytics Backend

Data synchronization, issue detection, and root cause analysis

Dashboard for product management, QA, and engineering teams:

- Quality trends: are things getting better or worse?
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Stability Analysis System Architecture

QNX/Hypervisor
ECUs, telematics, etc.
Vector box

Log fetching, data collection, etc.
Any module with any external interface: serial, SSH, ADB, etc.
STR*, signals, etc.

Main analysis / user modeling
Lab client

Data synchronization, issue detection, and root cause analysis

Dashboard for product management, QA, and engineering teams:

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STR* (Suspend-To-RAM)
Stability Analysis System Architecture

QNX/Hypervisor
ECUs, telematics, etc.

Main analysis / user modeling
Log fetching, data collection, etc.

Any module with any external interface: serial, SSH, ADB, etc.

Control

Lab client

Quality Analytics Backend

Data synchronization, issue detection, and root cause analysis

Dashboard for product management, QA, and engineering teams:

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RemotiveLabs platform

Easy to record, share and use real drive-cycles -> include vehicle behavior into the analysis
RemotiveLabs Platform

Empower vehicle software engineers to take ownership over their development environment.

工作协作，与同事分享数据。

RemotiveCloud

CLOUD COLLABORATION
Work collaboratively and share data with colleagues & partners.

REMOTE ACCESS

RemotiveBroker
RUNS ON ANY HARDWARE

PUTTING ENGINEERS AND TEAMS IN THE CENTER BY REDUCING DEPENDENCIES AND FACILITATING OWNERSHIP

IN-VEHICLE
Supporting prototyping, advanced engineering & logging in early stage project.

TEST RIGS
Left-shifting testing activities by enabling engineers to build and own their own SIL & HIL test rigs.

EXTERNAL APPLICATIONS
Connect to Profilence QA Suite.

RUNS ON ANY HARDWARE

REMOTE ACCESS

REMOTE ACCESS
Summary

- **Profilence**
  Quality analytics & user modeling

- **Infotainment system under test**

- **remotiveLabs**
  Stream recorded & live vehicle signals
Thank you for joining this session

More info at:
https://cloud.remotivelabs.com/
https://profilence.com/