Android in Automotive
A look back at challenges...

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Wind River Systems - Android

- Long history
  - 2007 Founding member of Open Handset Alliance
    - T-Mobile G1 – Android 1.0
  - 2009 Commercial Android release
    - Pre-integrated 3rd party SW
  - 2011 Collaborate with Clarion
    - Clarion AX1 IVI – Gingerbread
  - 2012 Honda PoC
    - KitKat: Fastboot, MOST integration, Audio Manager, apps
  - 2013 Honda production
    - 2018 Lollipop: Odyssey, RDX, TLX, Passport, Pilot, …
    - One code base, reusable across brands, HW…
 - 2019 …continues

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Fastboot

- If you can't – what is the point?
- Approaches:
  - Suspend to disk (RAM image, GPU reset)
  - Suspend to RAM (draw current, Google's solution)
  - Cold boot optimizations (bootloader, kernel, init.rc)
- Each Android version had new challenges (cold boot time, RAM use, flash throughput)
- Apps services → GO! I/O contention, cache miss
- Early camera
  - Reverse gear detection
- StartupManager – define priorities - Genivi?
- Today: still a huge issue. Opinions on new PM "deep sleep"?
  - https://source.android.com/devices/tech/perf/boot-times

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Android for Automotive

- Car API
  - Managers for HVAC, sensors,…
- CarService
- Vehicle Network Service
- Vehicle HAL
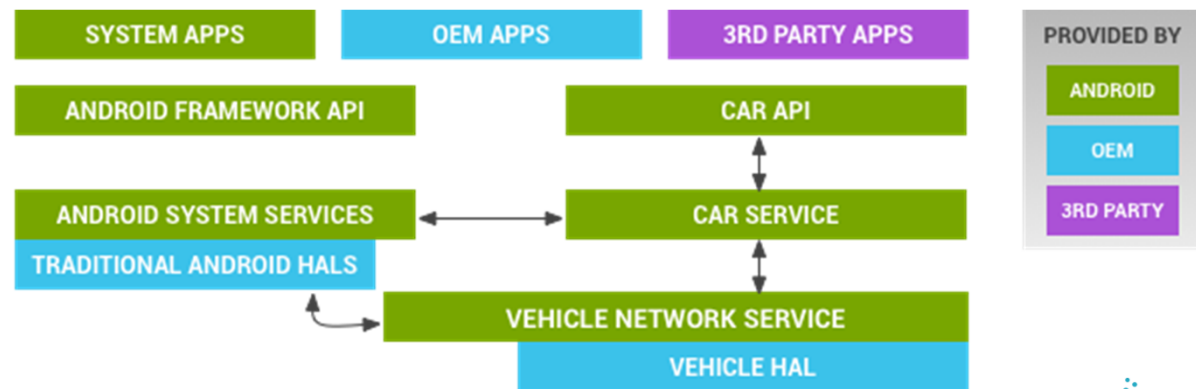
Vehicle HAL

- Property based: get, set, update event
- Lots of deprecations
  - Different ways to model vehicle
  - "Area" types: WINDOW, MIRROR, SEAT, DOOR, WHEEL
- Android access to vehicle buses?
  - Google wants to be "center of the universe"
  - Primary attack surface
  - Should have a firewall between Android and vehicle buses (not MOST) and know zero details
  - Android "security" for granular property access is compromised if the OS is
  - Obfuscation of device ID's, API's, values, etc. – reuse challenge
- External property management service? Genivi?

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LBS Framework

- Define interfaces for navigation engines
  - Enable portability
  - POI
  - Retrieve map images
  - Set or query route
  - Query heading, current speed limit, etc.
  - Traffic Info
- Genivi?

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Audio

- Multi-source multi-sink
- Stream types – not audio zones
- Still limited to one sink
- Google is still very "hand wavy" about solution
- WR: Highly modified HAL, "virtual sources", policy/focus management, flexible – data-driven
- Latencies
- Last two-miles left to IVI developer
- **(Android P improvements?) …more churn?**
- Genivi?

Certifications

- CarPlay
  - No love from Google for Apple
  - No help, figure it out
  - Consider distributed system (MOST)
  - Audio latencies
- Android Auto
  - Much easier (of course)
  - Still a separate license
- Need waivers for CTS/CDD failures/issues

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Persistent Services

- Genivi DLT can't live as native background service
- Requires Java wrapper started as an Android Service
- Services can still get killed
  - Modify Android? Startup Manager related? Genivi?
- Could run something inside Treble
- Truly persistent services still an issue

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Voice Recognition

- 3rd party API's don't map well to Android
  - Difficult to integrate
  - Tune accuracy vs. speed
  - Dynamic or "walk down a path"
- Native solutions need Java/Android wrapper
- Android intended for cloud solution
- Create an abstract API for Android? Genivi?

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3rd Parties & System Resources

- Many 3rd party products to integrate
- System architecture and resources usage
- Test suites of 3rd party stacks/apps/drivers…
- System testing – full stack coverage of tests written for new services or middleware modifications. E.g. communication frameworks.

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Logging & Other

- Overused ☹
- "Android L is a pig!"
  - Brings system to its knees
  - CPU hog
- Better now?
- Automated testing…things like audio quality. Unclear options for UI testing. More restrictive debugging based on debug vs. user builds.
- Upstreaming

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FACE in Avionics

- O/S interface – POSIX PSE51-53 and ARINC 653
- I/O interface – **Common I/O API** and messaging interface
- Transport interface – POSIX, ARINC 653, DDS, …

Future Airborne Capability Environment

Genivi?

- Vehicle services outside Android
  - Adaptive AutoSAR
    - Vehicle Properties
    - V2X
    - Camera's, sensors, …
    - Body domain controller, …
- LBS, VoiceRec, StartupManager, Audio, Persistent Services, Fastboot (on supported boards)

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Thank You!
Q/A