Google Automotive Impact Statement

Roger Lanctot
Director Automotive Connected
Mobility Strategy Analytics

GENIVI®

Global Automotive Practice

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STRATEGY ANALYTICS

WHAT WE NEED TO KNOW

- State of automotive connectivity

- A battle over user experiences/interfaces

- Impact of Google, Android, Apple (Amazon? Alibaba? Baidu?)

- Emerging role of digital assistants

- Driver monitoring – potential game changer

- Audience measurement on steroids

- Car as browser

- **Latest Strategy Analytics in-vehicle listening research**

STRATEGYANALYTICS

Voice-based digital assistants are rapidly bringing limited types of AI to our cars and our homes – AND **access to streaming radio content**.

- Amazon Alexa-enabled devices, such as the Echo smart speaker (pictured at right) are selling in large volumes.

- Strategy Analytics' Smart Speaker service estimates that full-year (2017) shipments reached 32 million units in the U.S., France, Germany, and China.

- That figure is up more than 300% year-on-year.

- Google and Amazon accounted for 9 out of every 10 smart speakers sold during that period.

Source: Amazon

OEMS' INFOTAINMENT AI PARTNERSHIPS

OEM	Digital Assistant	Status
Audi	Alibaba's Tmall Genie, PIA	Tmall Genie – Launch TBD PIA – Concept demonstration
BMW/MINI	Amazon Alexa, BMW Intelligent Personal Assistant	Alexa – Launched (BMW Connected mobile app integration), launching in MINI cars, this year BMW Intelligent Personal Assistant – Used cloud services from Microsoft that underpin Cortana to develop this solution, i.e. Microsoft white label solution provider
Ford	Amazon Alexa	Launched
Honda	HANA, Honda Personal Assistant	Hana – demonstrated, developed via SoftBank partnership Honda Personal Assistant – developed via partnership with SoundHound
Hyundai	Amazon Alexa, Google Assistant, SoundHound's Houndify	Alexa and Google Assistant launched, Houndify launched in Hyundai Venue in India
Mercedes	Google Assistant, Amazon Alexa, Tmall Genie, SoundHound	Google Assistant, Amazon Alexa launched April 2017 SoundHound to launch
Nissan	Google Assistant	Google Assistant – part of Google Automotive Services, which Renault-Nissan-Mitsubishi Alliance has adopted.
PSA	SoundHound's Houndify	Launch was planned for 2020
SEAT	Amazon Alexa	Launched in 2017
Toyota/Lexus	Amazon Alexa, YUI	Alexa – Launched in 2018 YUI – concept demonstration
Volkswagen	Amazon Alexa	Planned, launch date not yet announced
Volvo	Amazon Alexa, Google Assistant, Siri, Alibaba's Tmall Genie	Alexa, Google Assistant, Siri, works with OnCall App Tmall Genie- launch date not yet announced

Source: Infotainment & Telematics Service

October 2020

CoDriver for Driver Monitoring

Sensor:

- Face detection
- Alignment
- Pose
- Eyes open/openness
- Gaze Tracking
- Person ID, Age, Gender
- Anti-spoofiness
- Emotion
- Multi-people
- ....

States:

- Ready To Take Control
- Distraction
- Drowsiness
- Head bob/drop
- Distress
- Eye Blink, Sleep
- ....

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DRIVER MONITORING FORECAST

- Camera-based solutions forecast to deploy rapidly starting around now

- Legislative / NCAP interest in US and Europe
  - Europe NCAP for driver monitoring
  - US potential legislation for occupants left in hot vehicles

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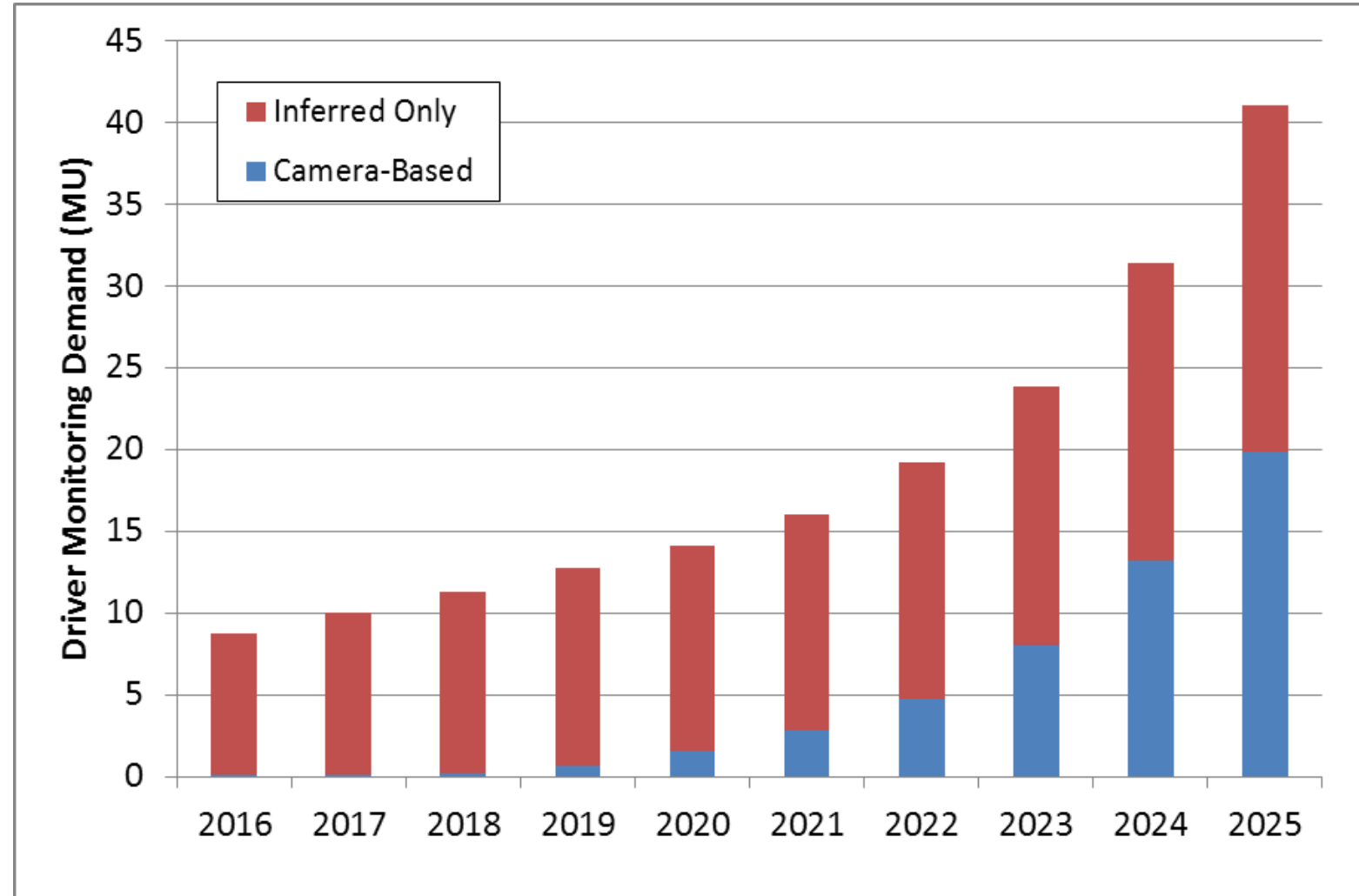
THE CAR IS A BROWSER
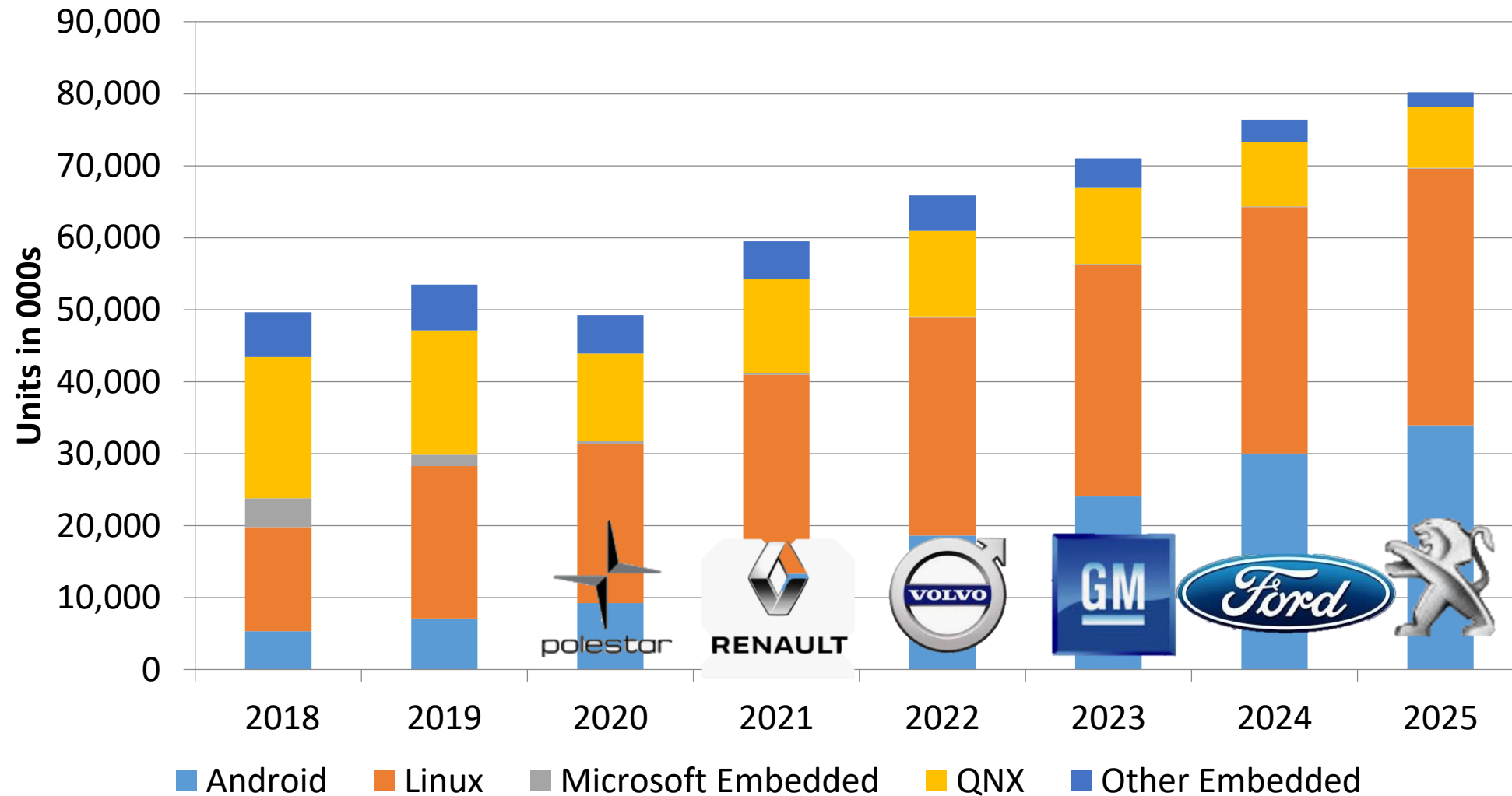
Intent

Attribution

Audience Measurement

THE MARCH TOWARD ANDROID ADOPTION IN CARS

Android OS: 5.5M in 2018 to 33.9M by 2025

Linux (incl. AGL and other Linux-based OSes): 14.4M in 2018 to 35.6M by 2025

Microsoft Embedded: 4M in 2018 to 108,000 by 2025.

QNX: 19.6M in 2018 to 8.4M by 2025.

Other Embedded: 6.2M by 2018 to 2M by 2025.

Legend: ■ Android ■ Linux ■ Microsoft Embedded ■ QNX ■ Other Embedded

Single OEM Requirement – Reliable Wireless Connections

- OTA updates – Maps, safety systems, application enhancements/upgrades, cybersecurity
- Streaming content – Audio and video
- At speed/in motion – Managing connections, multi-SIM solutions, signal switching
- Quality of coverage – Predictive models
- Connectivity management – Platform for identifying faults/gaps/weaknesses – with corrective measures

If data is the new oil, connectivity is the new fuel gauge!

Understanding the impact of Google and Android adoption

ANDROID AUTOMOTIVE

Android Automotive OS is an extension of Android Open Source Project.

It is not a fork or other version of Android. It is part of regular Android OS releases.

Google Automotive Services (GAS) is a suite of connected services and applications that Google offers to OEMs. They include:

- Googe Maps
- Google Assistant
- Google Play Store

OEM Commitments

- General Motors – 2021
- Renault-Nissan-Mitsubishi – 2021
- PSA/FCA – 2023
- Volvo – 2021 (XC40 Recharge)
- Polestar – In production
- Ford - 2023

- While some have suggested Ford and Toyota will remain on the sidelines – all indications are that MOST car companies are moving toward Android Automotive.

- Android Automotive comes with BT stack, media players, HMI framework, multi-display support, etc. – unlike Linux
- Android Automotive requires 2G RAM minimum + storage + processing
- Android Automotive deployment still requires patent fees for codecs
- Android R upgrades included support for BUS-based audio (for zonal audio), power management, fast boot, suspend to RAM

Major Features and Enhancements
System UI and Core Apps Improvements

Updated core system applications

New Settings search. Users can now quickly search for the relevant setting from the Settings Home Screen.
Media. Other features have been added for improved user experience, Customization enhancement for OEMs.
Dialer. Option has been added to sort by last name for improved user experience.
Messaging. Group Messages are now supported using MMS and RCS.

Improved flexibility for notifications. Capability has been added for improved customizability for on-screen position for notifications panel and heads-up notifications, and for improved customizability for heads-up notification animations.

Improved customizability for status bar icons. Spacing between icons can be customized, some icons can now be excluded.

Automotive UI toolkit. A new set of components and resources have been added to allow for easier, more predictable, and more consistent OEM customization of the system.

Baseline rotary support. VHAL events for a physical rotary controller are plumbed through to RotaryController service so that the apps can be made to work with the rotary controller.

User Management

Updated Multi-User APIs. Moved Android AutomotiveOS multi-user management API surface (e.g. CarUserManagerHelper) into core framework (for example, UserManager) to make OEM integration and upgradability easier.

User roles and restrictions. Support has been added for easier OEM customization of User roles and restrictions.

Faster user switching. User switching and multi-user performance has been improved. User pre-creation and removing packages from system user is possible now.

CarUserHAL. User management (for example, switch Users) integration between external ECUs and Android is now supported.

Trusted device unlocking. Improvements have been made to unlocking performance of Users and system experience

ANDROID AUTOMOTIVE – ANDROID 11

Bluetooth

Cover art. Cover art for currently playing and browsed tracks via AVRCP can now be received.

MMS and RCS. Sending and receiving MMS and RCS messages are now supported in addition to SMS.

Vendor AT commands. Capability has been added to support sending vendor AT commands over HFP to enable 3P projection.

Synchronization of favorite contacts. Favorites phone book can now be transferred from phone to car.

Improve support for multiple browsable media sources. Improved support for signals from phones supporting multiple media players, and changing of those media players.

AVRCP improvements. Media control capability has been improved.

Contact downloads. Contact downloads are now batched to get available contacts into the database sooner.

Multiple Displays

Emulator support. Android Automotive OS emulator now supports multiple physical displays.

Boot animation for multiple displays. Multi display boot animation is now supported.

CarActivityView. ActivityView is now aware of the driving restrictions.

Connectivity

Hotspot client browsing and management. Partners can now view a detailed list of connected AP clients and display or block clients.

Dynamic Wi-Fi interface management. Support has been added to create and remove Wi-Fi network interfaces dynamically to support Wi-Fi concurrency use cases and reduce fragmentation around current one-off implementations.

Silent wireless connection to Automotive HUs. Privileged apps can now be silently connected to Wi-Fi.

Audio

Audio effects per output device. Audio effects to specific output devices in addition to per-stream can be applied now.

Multi-zone improvements. Multi-zone audio now supports routing based on user and car occupancy. Additionally, audio inputs can be associated with zones for easier device lookups.

Supporting vehicle sounds. New system usages have been introduced to cover automotive use cases. Also, new APIs have been added to enable the HAL to participate in audio focus for sounds outside of Android.

Audio focus improvements. Delayed audio focus requests are now supported, and a new user setting for preventing navigation from gaining focus during a call has been added.

Camera

Surround view. Capability has been added to display 360° surround view from multiple camera inputs.

Computer Vision and Machine Learning (CV and ML)

Computepipe on Android Automotive OS. A CVML client implementation in Android now allows connecting with CVML pipelines regardless of which environment they are running in (VM or discrete HW) in a manner that abstracts the underlying deployment architecture.

Sensors

Ultrasonics. Support for ultrasonic sensor arrays has been added to the platform.

CarPropertyManager. Improvements have been made to permission granularity for the Vendor property, exposed error callback, and a simplified getProperty API.

Country detector. Allow Automotive customization to enable OEMs to set a country code other than the default for location detection (specifically for cases in which there is no telephony provision in a car).

GNSS. Unlimited satellite can now be reported (increased from the maximum of 64 previously supported.

System Reliability and Stability
Watchdog has been added to detect problematic process and restart it.

Boot Performance
IO performance data is collected now as part of CarWatchDog service.

Car Framework
Optional and experimental features are now supported.
The capability has been added for activity crash monitoring and restart for crashed activity running in a cluster (FixedActivity mode).
Car service crash handling has been improved.
CarOccupantZoneManager API has been added to allow querying the right display/audio for specific usage.
CarInputManager has been added to enable the capturing of a selected group of input events.

CAN bus HAL for standardized CAN bus access has been added.

Power Management
Power management service logic now supports new transitions.
WAIT_FOR_VHAL_FINISH to WAIT_FOR_VHAL, and SHUTDOWN_PREPARE to sleep immediately.

TREBLE

- Managing software update process

- Looking to lock down the software kernel

- Limit updates to application layer

- Expanding the certification process and elements

KEY CONCLUSIONS

- Car companies, Tier 1's coming to grips with the narrowing in-dash functional domain over which they will have control

- Android's arrival coincides with the rise of cockpit domain controllers – but does not suggest a shift of Android into the functional safety domain or Autosar

- The arrival of Android means the connected car will fast be becoming more common of necessity – for OTA, cybersecurity, etc.

- Android may be a less expensive development environment – but supporting Android in cars will be expensive long-term

- Onset of Android will legitimize the development and introduction of hardware aftermarket upgrades