ACTION ITEMS FOR MEETING ON 10TH JULY.

- **To-Do @all:** Providing e-mail address to Paul Boyes (COVESA) if you want to participate in virtual meeting
- **To-Do @all:** Deciding for a license models (https://www.covesa.global/sites/default/files/COVESA-Public-Policy-for-Open-Source-Licensing.pdf)
- **@Sven Eckoldt (Cariad):** To clarify with Harman if they are willing to contribute to COVESA app developer documentation
- **@Thijs van Herkhuizen (Faurecia Aptoide):** Map best practices structure with Faurecia documentation
- Identify right whitespots: Compile the cross-OEM incompatibility issues that app developers are facing
  → **@Thijs van Herkhuizen (Faurecia Aptoide):** First overview of deviations from App Store Provider perspective
- **To Do @all:** Overview of timeline/ milestones for identified priorities; what do we need to achieve to claim it a success (reference implementation vs. sample code), who takes the lead:
  - Cross-OEM emulator (including automotive host)
  - Camera API
  - Push notifications
  - Issues to bring mobile versions of Video Apps to Automotive
    → **To Do @all:** Overview what is necessary to benefit from working group
- **@Melina Mascolo (BMW):** Clarifying with COVESA how Best Practices for App Developers could be published

ACTION ITEMS FOR MEETING ON 17TH JULY.

- Having “trusted team” of app developers validating scope and work results of expert group
  → **To Do @all:** Getting first ideas which app developers could be interested
  → Goal: Depending on the defined work streams, involving relevant app publishers early in the process to discuss solutions for the problem being addressed
- **@Juhani Lehtimäki (Snapp Automotive):** Providing overview to expert group what Snapp emulator already provides
  → Exploring how Snapp and Remotive Labs product could interact
- **@Emil Dautovic (Remotive Labs):** Providing overview what Remotive Labs is offering regarding Cross-OEM emulator
- **@Sven Eckoldt (Cariad):** Overview of issues seen when bringing mobile video app to automotive (e.g. DRM, HCP, button size, immersive mode, etc.)

IDENTIFIED WORKSTREAMS.

- Cross-OEM emulator (including Automotive Host)
- Camera API
- Best Practices
- Push notifications
- Video Apps @ Automotive
- Tbd.: Developer Communication via COVESA

AUTOMOTIVE AOSP APP FRAMEWORK STANDARDIZATION

Expert Group

22.06.2023

COVESA

Accelerating the future of connected vehicles

WELCOME

Graham Smethurst, COVESA/ BMW

COVESA

Accelerating the future of connected vehicles

Antitrust Note Well

Before we begin, we would like to make clear that COVESA is committed to compliance with the antitrust laws in all of its activities, and that it expects all participants to similarly comply with the antitrust laws. We will not engage in--and members must refrain from--any discussion of, or understandings regarding competitively sensitive topics. If you have any doubts regarding whether a matter is appropriate for discussion, please consult with your antitrust counsel.

BMW STARTUP GARAGE

THE VENTURE CLIENT UNIT FOR STARTUP ENABLED INNOVATIONS.

OUR BUSINESS MODEL: MATCHMAKING NEW (TECHNOLOGY-) SOLUTIONS AND BEYOND.

UNDERSTANDING Future

Mobility-/Tech **TRENDS**

THINK TANK: Future Mobility

White Paper

Tech-Trend Radar

Reports

MATCHMAKING New Technology SOLUTIONS and beyond

Innovation **POTENTIAL**

- CROSS INDUSTRY TECHNOLOGIES
- STARTUPS
- INNOVATION CROWDS, EXPERTS, …
- INTRAPRENEURS

TECHNOLOGY SCOUTING

BMW Startup GARAGE

CROWD INNOVATION

ACCELERATOR Building next BMW Business.

Innovation NEED

BMW GROUP

Business Units / Product Lines

B2C

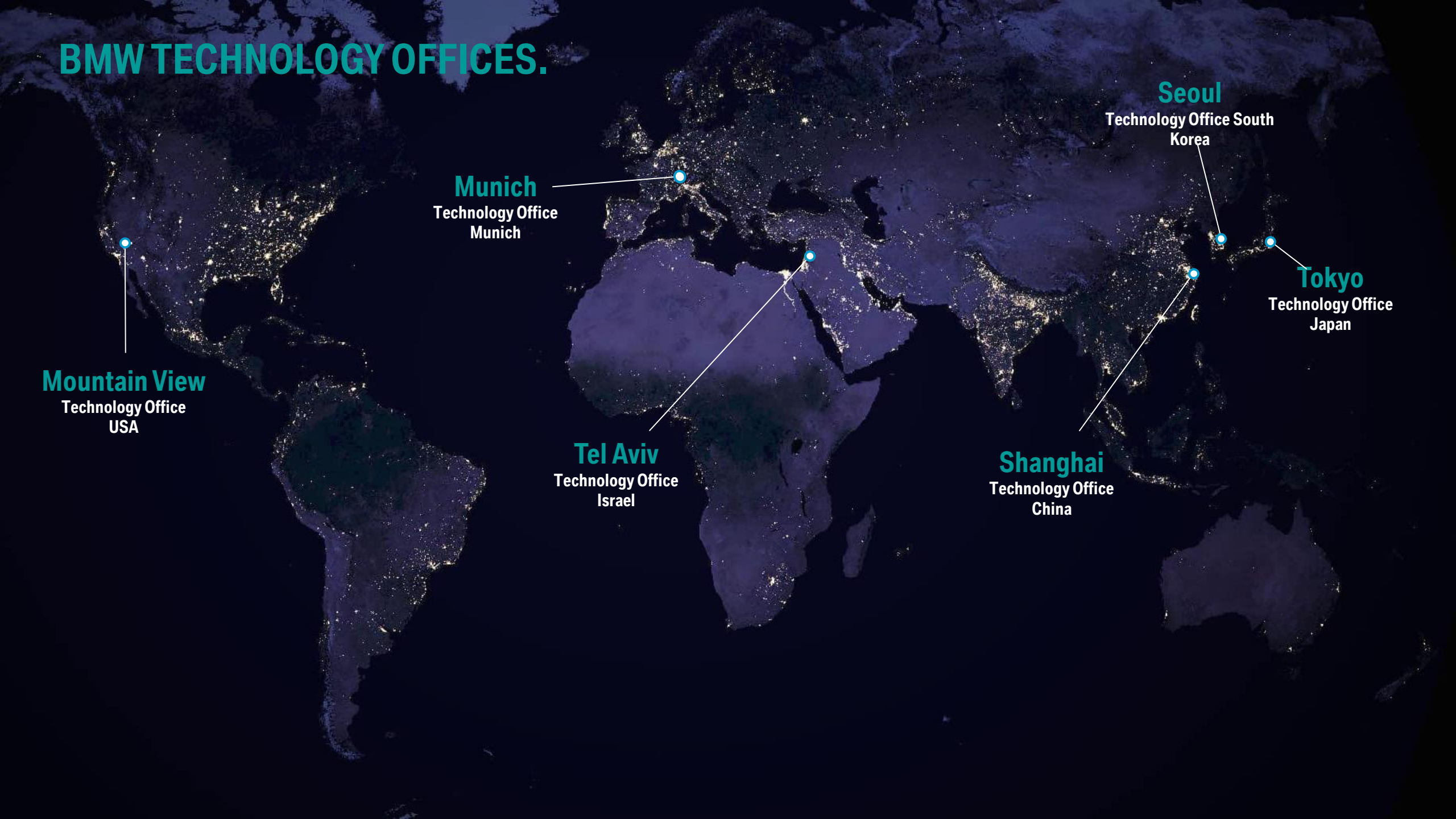
B2B

(B2G, 3rd)

Building **Knowledge,** Enabling **Decisions**

PROOF of CONCEPT Projects => Sustainable Transfers

BMW TECHNOLOGY OFFICES.



WHY?
OPEN INNOVATION.

Drivers

Fast emerging cross-industry tech trends

New innovation drivers / ecosystems

Changing competition landscape

OPEN Innovation

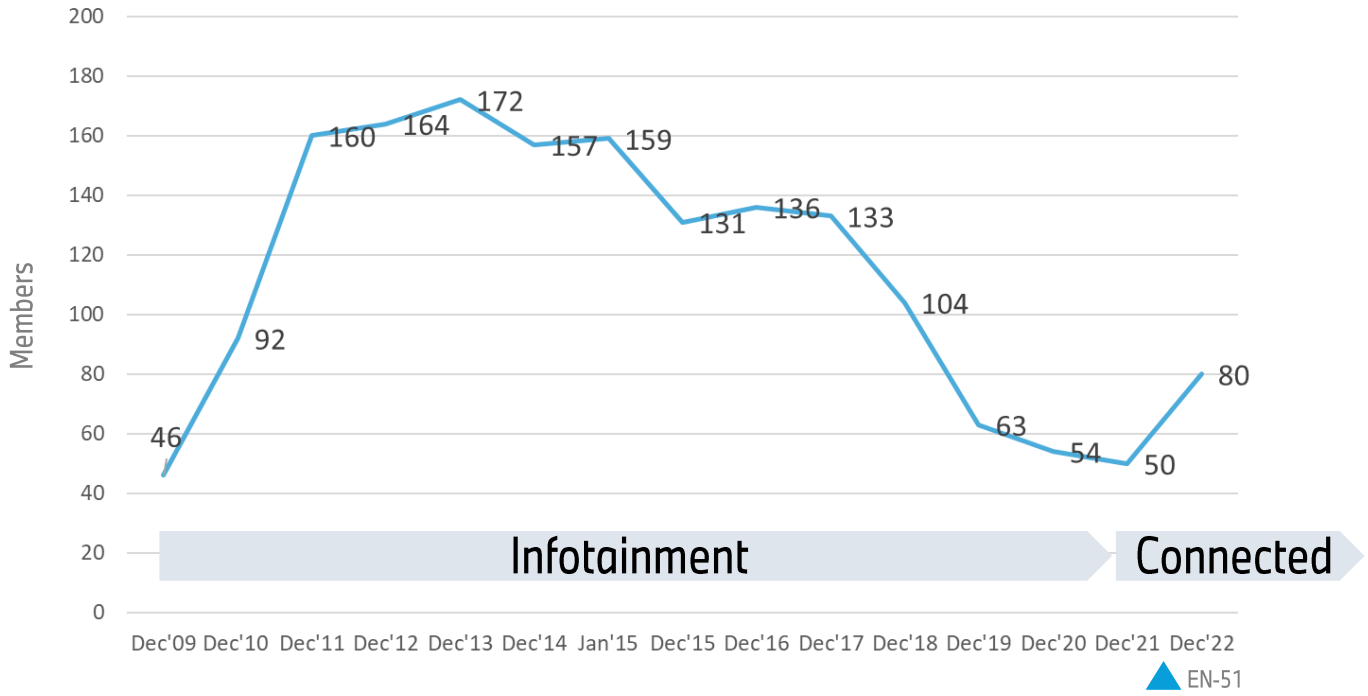
Contribute to → Innovation Leadership

Searching **BEYOND** the obvious

Unlocking **UNCONVENTIONAL** innovation sources

Delivering **FAST** results

GENIVI Alliance 2009 - 2021



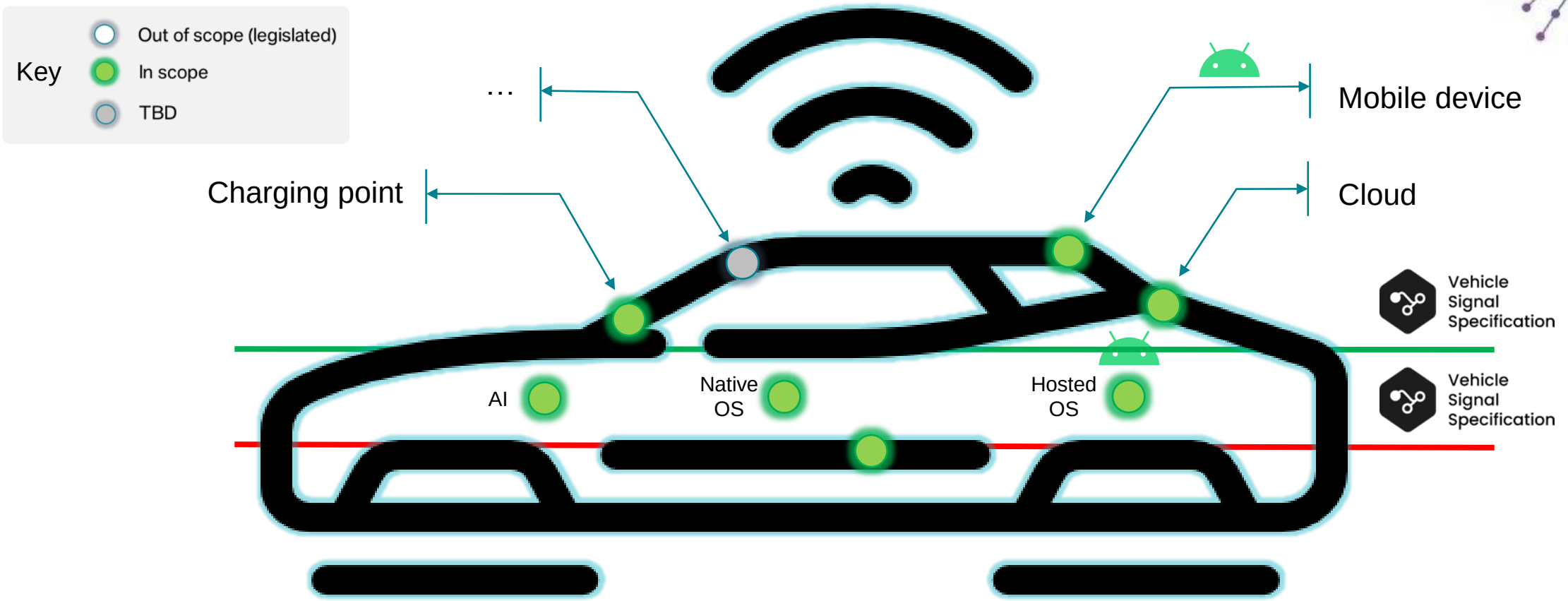
GENIVI (2009-2010) Start-up → GENIVI (2011-2013) Initial Production Delivery → GENIVI (2014-2016) IVI Maturity → GENIVI (2017-2020) Decline into Non-relevance → GENIVI/COVESA (2021-2022) Re-scope / Rebrand

GENIVI

COVESA

GENIVI Membership EOY 2013 172

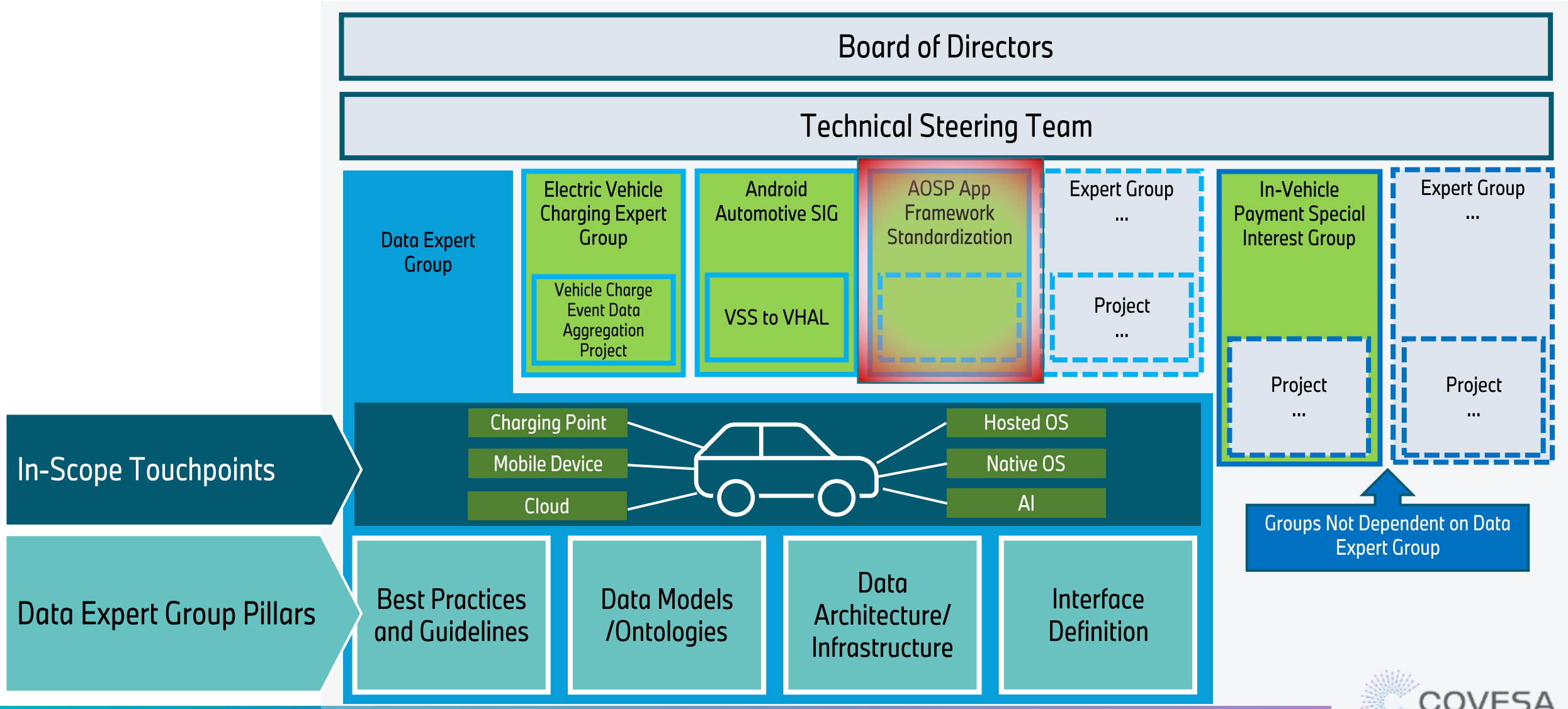
COVESA Scope



Common consistent data BASIS across multiple touch-points.

https://www.covesa.global/

COVESA Data Expert Group – Organization



AGENDA

COVESA

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AGENDA MORNING.

1. **10:00 - 10:30: Election Co-Chairs**
2. **10:30 - 11:30: Meeting cadence & next steps**
3. **11:30 - 12:15: Critical success factors for Expert Group**

12:15 – 13:45: LUNCH ☺

AGENDA AFTERNOON.

4 **13:45 - 14:30: Reference implementation in-vehicle camera access**

5 **14:30 - 15:00: Best practices automotive AOSP app development**

15:00 - 15:15: Short break

6 **15:15 - 16:00: Android for Cars usage for AOSP based Systems**

7 **16:00 - 16:30: Planning further F2F events/ presentations**

8 **16:30 - 17:00: Meeting wrap-up**

17:00 - 20:00: Evening Get-Together & light snacks

CO-CHAIRS

Steve Crumb, COVESA

22nd June 2023

COVESA

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ELECTED CHAIRS.

Chair

Richard Fernandes

General Motors

Chair

Melina Mascolo

BMW

Chair

Camille Ghibaudo

Faurecia Clarion Electronics

*Volvo also volunteered as chair, due to them not being official COVESA member yet, it was parked for later point of time

MEETING CADENCE

Steve Crumb, COVESA

22nd June 2023

COVESA

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MEETING CADENCE & NEXT STEPS.

- Weekly vs. biweekly virtual calls?
- Which timezones do we need to cover?
- How often do we want to meet in-person?

Protocol

- Chosen virtual slot: Monday: 5-6pm CET*; Microsoft Teams
- First meeting 10th July
- @Melina Mascolo (BMW) to set up virtual call
- **To-Do @all:** Providing e-mail address to Paul Boyes (COVESA) if you want to participate in virtual meeting
- Quarterly in-person meetings, e.g. COVESA AMMs & CES

* Time slot could be adjusted in the future for some meetings, if there is interest from Asian partners to join as well

OPEN QUESTIONS RAISED BY COVESA FOR EXPERT GROUP.

Protocol

- Preferred License model for working results of Expert Group
- Overview license models: https://www.covesa.global/sites/default/files/COVESA-Public-Policy-for-Open-Source-Licensing.pdf
- **To-Do @all:** Getting overview of license models
  → Decision which one to use: Virtual meeting 10th July

CRITICAL SUCCESS FACTORS

Everyone ☺

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CRITICAL SUCCESS FACTORS.

Jointly collected

Protocol

- Supporting E2E journey for app developers with unified documentation and guide how to develop / intergrate automotive app
- Clear scope of expert group: AOSP
- Finding way to prevent OEM specific fragmentation (e.g. with plugfests)
- Avoidance to create sub-standards to already existing AAOS-standards
  → Clear focus on standards that are not available at all, or only available for OEMs using Google Services as part of AAOS
- Involvement of application partners, to understand their friction points
  → On workstream basis vs. open meeting for all interested app providers
- Avoiding too many loose ends that app developers experience on OEM-side leasing to hesitance to develop automotive app
- Template that devs can leverage to develop cross OEMs
  → Navigation template
- Getting clear scope for expert group what OEMs vs. app developers want to achieve
- Having “trusted team” of app developers validating scope and work results of expert group
  → **To Do @all:** Getting first ideas which app developers could be interested
- Frequently reviewing if AAOS standards have been extended
  → **@José Freitas (Faurecia Aptoide):** Providing update to Expert Group in case new standards came up
- Step-by-step approach to include app developers
  - 1) Getting clear scope and workstream overview within expert group
  - 2) Involvement of first batch of app developers to proof-of-concept scope
  - 3) Involvement of larger audience of app developers

CRITICAL SUCCESS FACTORS.

Jointly collected

- Open topic: How to open-up a feeback loop to Google?
- Explore way to contribute to AOSP with working results of expert group
- Defining marketing model of COVESA: How to attract app developers for automotive in a scalable way
  → Goal: Activate developer community to engage with Automotive
- Clarify interaction with data expert group and android abstraction within COVESA?
- Providing reference implementations for developers, especially if deviating from AAOS templates
- Identify right whitespots: Compile the cross-OEM incompatibility issues that app developers are facing
  → **@Thijs van Herkhuizen (Faurecia Aptoide):** First overview from App Store Provider perspective
- Building compatibility test suite to get overview which OEMs are compatible
- Overview of timeline/ milestones for deliveries:
  → **To Do @all:** Preparing this for meeting 10th July
- Joint goal to provide broader content experience to OEM customers
- Prodviding Cross-OEM Emulator to app developers to support development/ testing
  → Already frist emulators available (Snapp Automotive; Remotive Labs)
  → **@Juhani Lehtimäki (Snapp Automotive):** Providing overview to expert group what Snapp emulator already provides
  → Exploring how Snapp and Remotive Labs product could interact
- Open topic how to keep up with changes, do we need some kind of version controlling for expert group implementations?

IN-VEHICLE CAMERA ACCESS

Manuel Saraiva, BMW

22nd June 2023

COVESA

Accelerating the future of connected vehicles

MOTIVATION & GOAL.

Presented Work in progress

In-Vehicle Camera Access.

- App Developers are requesting access to in-vehicle cameras, e.g. Communication Apps / Social Media Apps.
- Access to in-vehicle cameras is automotive specific, beginning Android 13
- Frequently asked questions from developers:
  - Which cameras can/should be accessed? What is the default camera?
  - Is compatibility ensured across OEMs?
  - Should apps already prepare for Android 13 in order to stay compatible?

- **Goal:** Providing a reference implementation via COVESA GitHub for App Developers
  - Working across Android OS versions
  - Granting access to inside- & outside-facing cameras
  - Ensuring compatibility across OEMs using AOSP / GAS

CLARIFICATIONS OEMS.

Presented
Work in progress

In-Vehicle Camera Access.

Camera libraries and APIs in Android have a set of characteristics, one of them being the **LENS_FACING**.

This property informs 3rd-party developers which camera to select.

- **AAOS (Android 13 or higher):**
  - Introduction of AUTOMOTIVE_LENS_FACING, allowing to access variety of in-cabin cameras
  - Precondition: FEATURE_AUTOMOTIVE system flag (PackageManager.hasSystemFeature API)
  - Standardization:
    - In-Cabin Camera: INTERIOR_SEAT_ROW_1_CENTER

      → Should this be the default or rather LEFT / RIGHT?
    - Front-facing exterior Camera: EXTERIOR_FRONT
  - LENS_FACING can be supported in addition to AUTOMOTIVE_LENS_FACING
- **Android or AAOS (up to Android 12):**
  - Standardization:
    - In-Cabin Camera: LENS_FACING_FRONT
    - Front-facing exterior Camera: LENS_FACING_BACK

Possible values:

- `EXTERIOR_OTHER`
- `EXTERIOR_FRONT`
- `EXTERIOR_REAR`
- `EXTERIOR_LEFT`
- `EXTERIOR_RIGHT`
- `INTERIOR_OTHER`
- `INTERIOR_SEAT_ROW_1_LEFT`
- `INTERIOR_SEAT_ROW_1_CENTER`
- `INTERIOR_SEAT_ROW_1_RIGHT`
- `INTERIOR_SEAT_ROW_2_LEFT`
- `INTERIOR_SEAT_ROW_2_CENTER`
- `INTERIOR_SEAT_ROW_2_RIGHT`
- `INTERIOR_SEAT_ROW_3_LEFT`
- `INTERIOR_SEAT_ROW_3_CENTER`
- `INTERIOR_SEAT_ROW_3_RIGHT`

INFOS FOR DEVELOPERS.

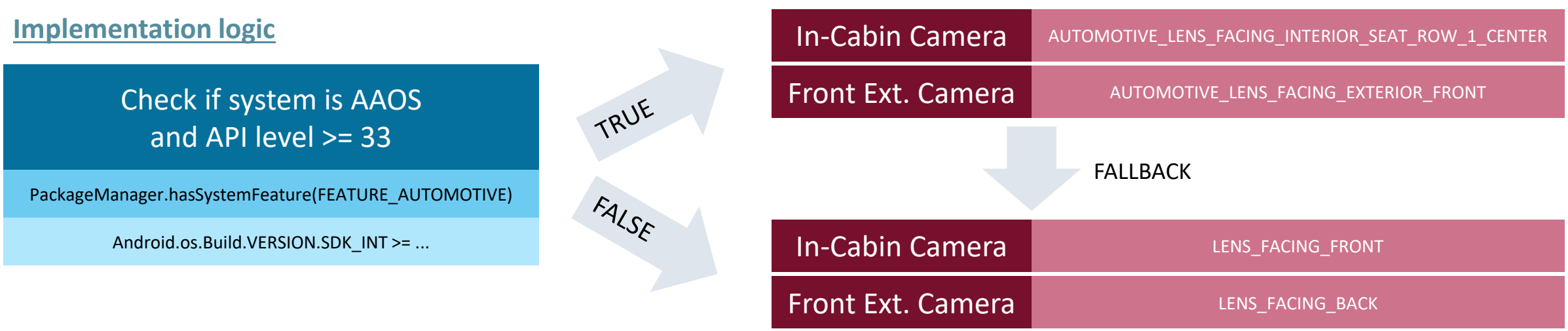
Presented
Work in progress

In-Vehicle Camera Access.

Guidelines

- AUTOMOTIVE_LENS_FACING only exists in Camera2, not CameraX
- App targetSdk should be 33 where AUTOMOTIVE_LENS_FACING was introduced (Android 13)
- App minSdk should be 24 because PackageManager hasSystemFeature API is required

Implementation logic



Obs: these are only for the default lens facing apps can expect in automotive, but they can still use Camera2 APIs to enumerate the different cameras and characteristics/metadata.

NEXT STEPS IN-VEHICLE CAMERA ACCESS.

- **To Do @all:** Checking if any disagreement with mapping of the first proposal (slide 27, implementation logic)
- Tbd: Check with Google how Android for Cars is abstracting driver/passenger cameras and/or left/right-hand-driving cars
- **@Thijs van Herkhuizen (Faurecia Aptoide): T**o loop in app developers to get their perspective (and also contribute to the overall list of pain points)
- *Comment from Dutt, Yagya (Mercedes Benz)*: LENS_FACING values could be limited, need to extend? Backport from Android 13?
- *Insight from session:* There is an API for camera characteristics allowing to determine where camera is located
  → Might be interesting to include this information in developer guide

BEST PRACTICES: AUTOMOTIVE AOSP APP DEVELOPMENT

Melina Mascolo, BMW

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BEST PRACTICES: AUTOMOTIVE AOSP APP DEVELOPMENT.

Is there a joint interest to have COVESA as kind of developer community?

E.g. with FAQ, collection of learnings from App Stores/OEMs/Developers

BEST PRACTICES: AUTOMOTIVE AOSP APP DEVELOPMENT.

Jointly collected

- Collecting needed adaptions for journey how to bring mobile app to automotive
- **Structure / biggest identified pain points:**
  - Differences Android vs. Android Automotive
  - Audiofocus
  - Link handling (developers should not assume that OEMs provide browser for external link handling)
  - Interaction with back button /home button
  - Solving GMS dependencies, e.g. Firebase, Google Login, Google Play linking
  - Payment
    → Already existing group regarding payment in COVESA (involving Stellantis, mavi.io)
    → **@Vamsi Krishna (mavi.io):** Providing update to Expert group about existing payment activities
  - Login process
  - Notifications
  - Camera access
  - Immersive mode: Interaction climate bar / full screen
  - How to integrate/test app
  - Prioritized at later point of time: Driver workload/ driver distraction
    → **@Sven Eckoldt (Cariad):** Check if you can provide your insights/ guidelines to expert group
  - **@Thijs van Herkhuizen (Faurecia Aptoide):** Checking what Faurecia Aptoide can provide from their documentation already
- **@Sven Eckoldt (Cariad):** To clarify with Harman if they are willing to contribute to COVESA app developer documentation
- Longterm goal to have reference app everyone contributes to (displaying camera, playing sound, send notification, etc.)
  → There is potential to refer to Google reference applications or open source applications built for Android Automotive such as EVMap

AUTOMOTIVE AOSP ECOSYSTEM AND RISKS OF FRAGMENTATION

José Freitas, Faurecia Aptoide

COVESA

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Agenda

1. Automotive AOSP vs Cars with Google Built-in (Ecosystem differences)
2. Android for Cars: Categories of Apps and Risks of Fragmentation
3. Cars App Library and Automotive App Host
4. Communication Apps
5. Key Takeaways

Presented
Work in progress

Automotive AOSP vs Cars with Google Built-in (Ecosystem differences)

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Automotive AOSP

Presented
Work in progress

- Automotive AOSP (a.k.a. “Android Automotive”, or Android Automotive OS) is open source
- ***“Android Automotive is Android”***: *“Android Automotive is not a fork or parallel development of Android.”*
- ***“Android Automotive extends Android”***: *to add “support for automotive-specific requirements, features, and technologies.”*
- Automotive AOSP does not include Google Automotive Services (GAS)
- OEMs using Automotive AOSP need to provide or source solutions for:
  - Maps
  - Voice Assistant
  - Apps distribution
  - 3rd party apps features dependent on GAS (e.g. Google Pay, Automotive App Host Maps rendering, etc.)

Android is a trademark of Google LLC.

https://developers.google.com/cars/design/automotive-os

https://source.android.com/docs/devices/automotive/start/what_automotive

https://developer.android.com/training/cars/google-services

Automotive AOSP vs Cars with Google Built-in

Presented
Work in progress

Maps

App Store

Voice Assistant

3rd party apps

Google Automotive Services

- Ecosystem driven by OEMs and App store providers, following official Android documentation
- Less focus on “templated” apps when compared to GAS systems → **Risk of fragmentation/apps incompatibility**

- Ecosystem driven by Google together with OEMs
- More focus on **“templated” apps** that can be deployed to Android Auto and Android Automotive OS

Presented
Work in progress

Android for Cars

Categories of Apps and risks of fragmentation

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Android for Cars Categories of Apps

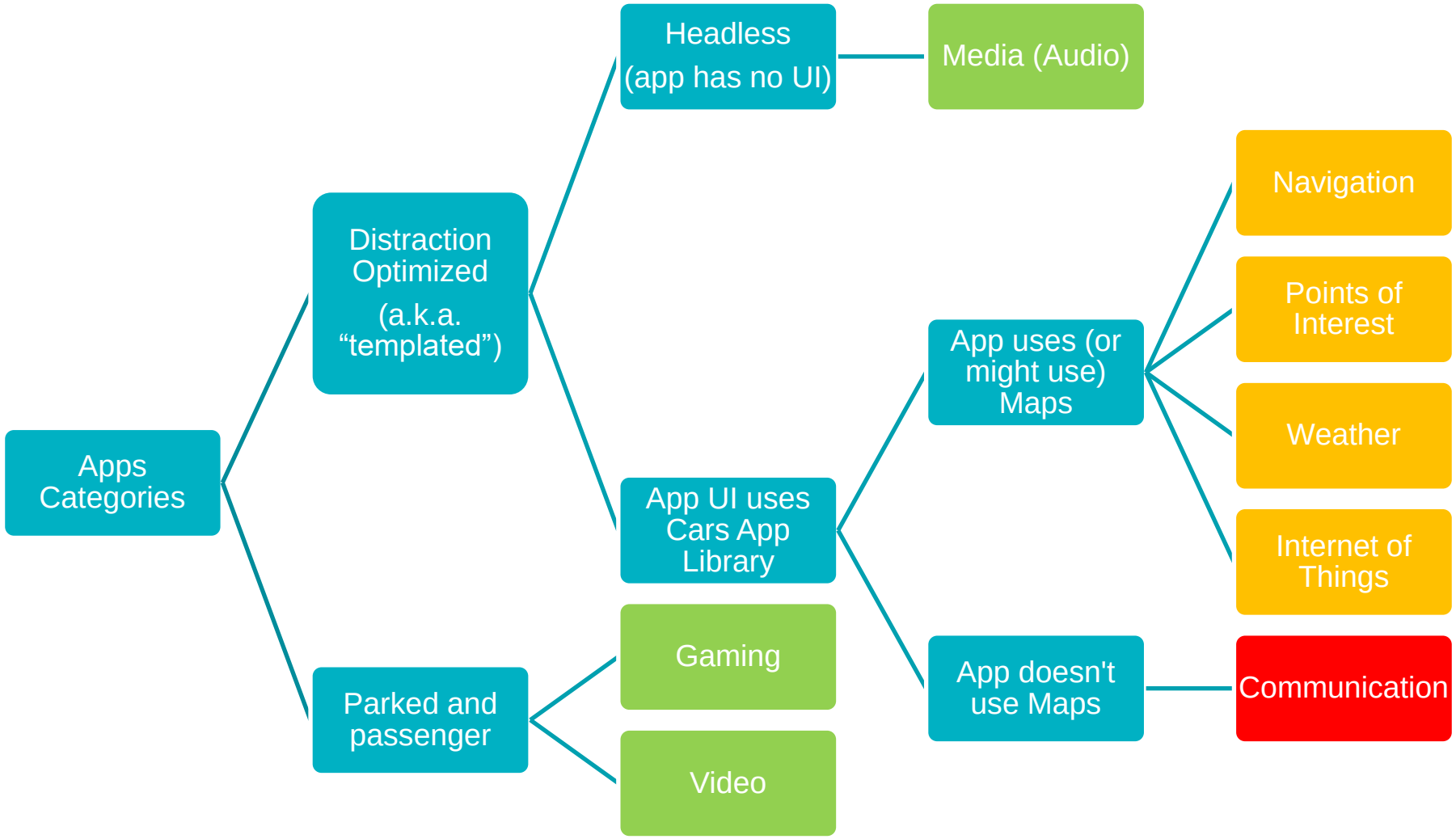
- Categories of Apps
  - Media (audio)
  - Messaging (*)
  - Navigation
  - Point of Interest (POI)
  - Internet of Things (IOT)
  - Weather (**)
  - Video
  - Games

"Bring your app to vehicles running either Android Auto or Android Automotive OS. Use one app architecture that works for both cases so every user can enjoy your app."
https://developer.android.com/training/cars

(*) Only Android Auto for now, Android Automotive expected soon
(**) "*weather is in an early access program*" (no public documentation yet)

https://android-developers.googleblog.com/2023/05/whats-new-with-android-for-cars.html
https://developer.android.com/training/cars#supported-app-categories

Typology of Apps



(Current) Risk of fragmentation/ incompatibility

- Low
- Medium
- High

Presented Work in progress

https://developer.android.com/training/cars#supported-app-categories

https://source.android.com/docs/automotive/driver_distraction/guidelines#do

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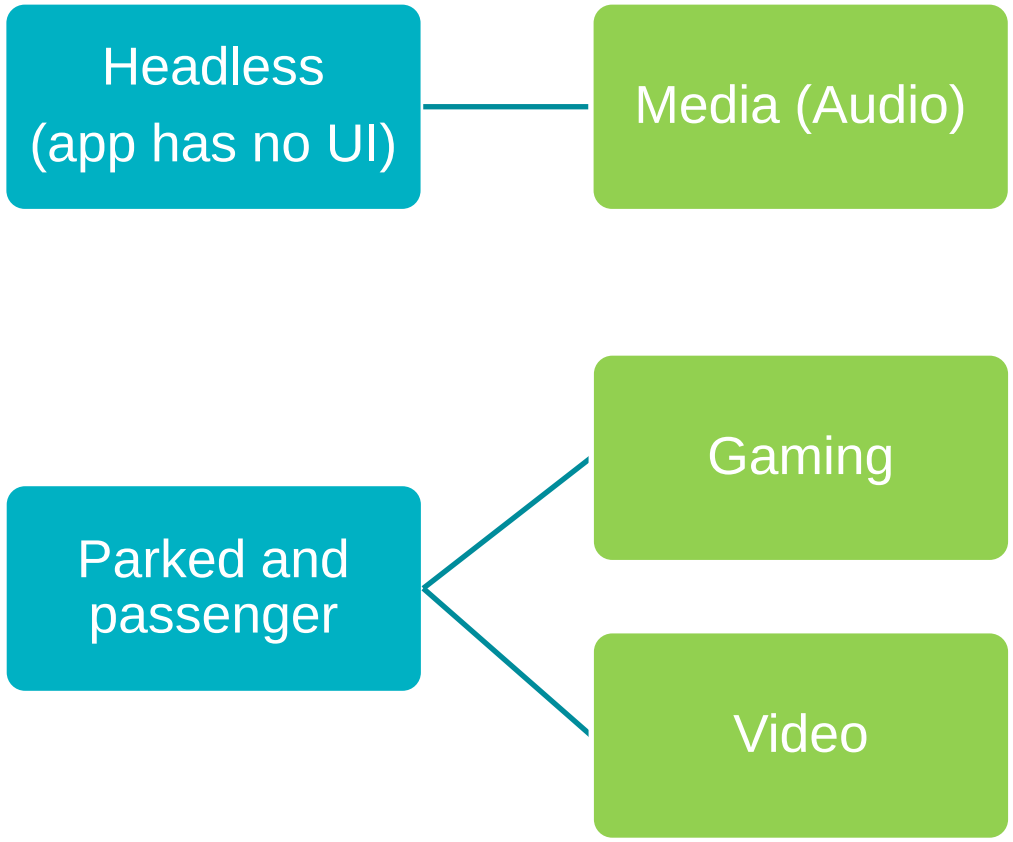
The easy ones first: Media(Audio), Gaming, Video

Presented
Work in progress



- Audio streaming apps are headless services (no UI)
- UI is from IVI system Media Player (AOSP or OEM custom)
- Interfaces are stable and understood by OEMs and Apps publishers

- Gaming apps have their own UI (simple or no adaptation from mobile)
- Risk of incompatibility only for in-app purchases

- Theoretically no risk of incompatibility …
- … however official documentation mentions a dependency to `android-automotive-video` library

https://developer.android.com/training/cars/parked/video

https://developer.android.com/training/cars/parked/games https://developer.android.com/training/cars/media

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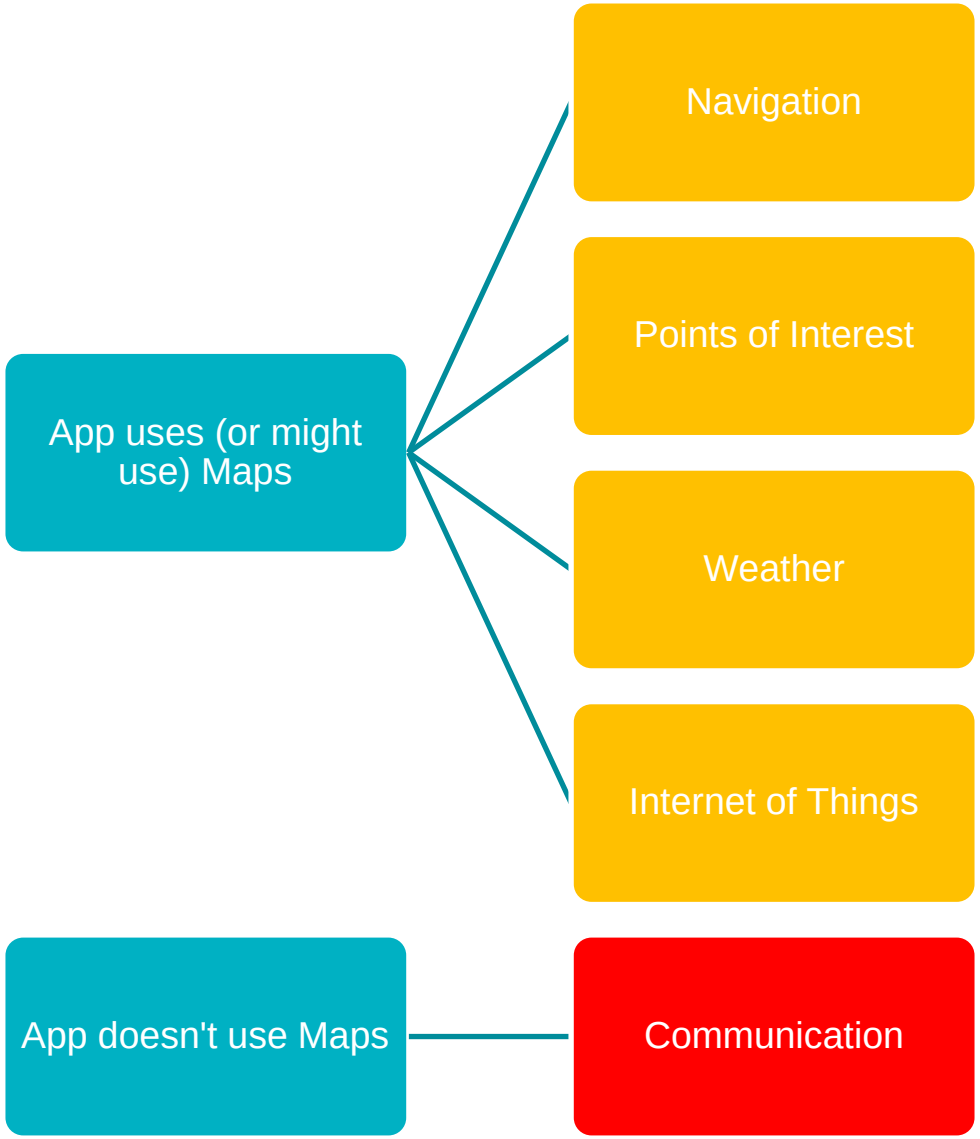
Apps that Use Cars App Library



- **Implications for Apps Publishers**
  - Build their apps using Cars App Library and its templated components
  - Test their app in a representative environment (e.g. emulator)

- **Implications for OEMs**
  - Integration of Automotive App Host (but AOSP version doesn't support maps)
  - Customization of Car UI Library

https://source.android.com/docs/automotive/hmi/aosp_host

https://source.android.com/docs/automotive/hmi/car_ui/appendix_b

Presented
Work in progress

Car Apps Library and Automotive Host

For Navigation, POI, IOT and Weather Apps

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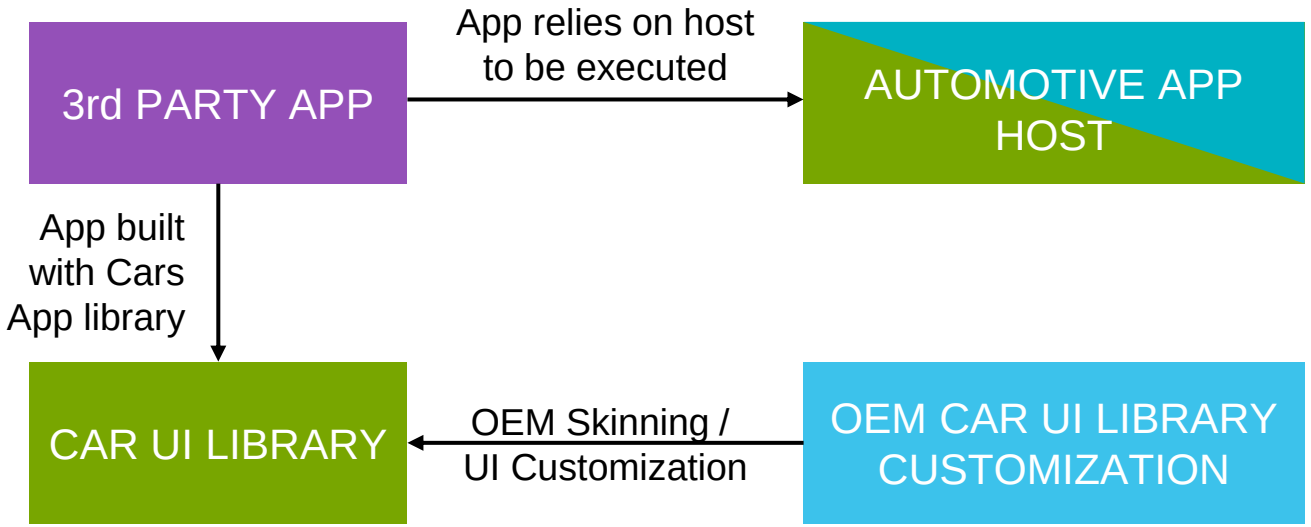
Dependencies for Apps using Cars App Library

Presented Work in progress



CarAppService is an abstract Service class that your app must implement and export to be discovered and managed by the host.

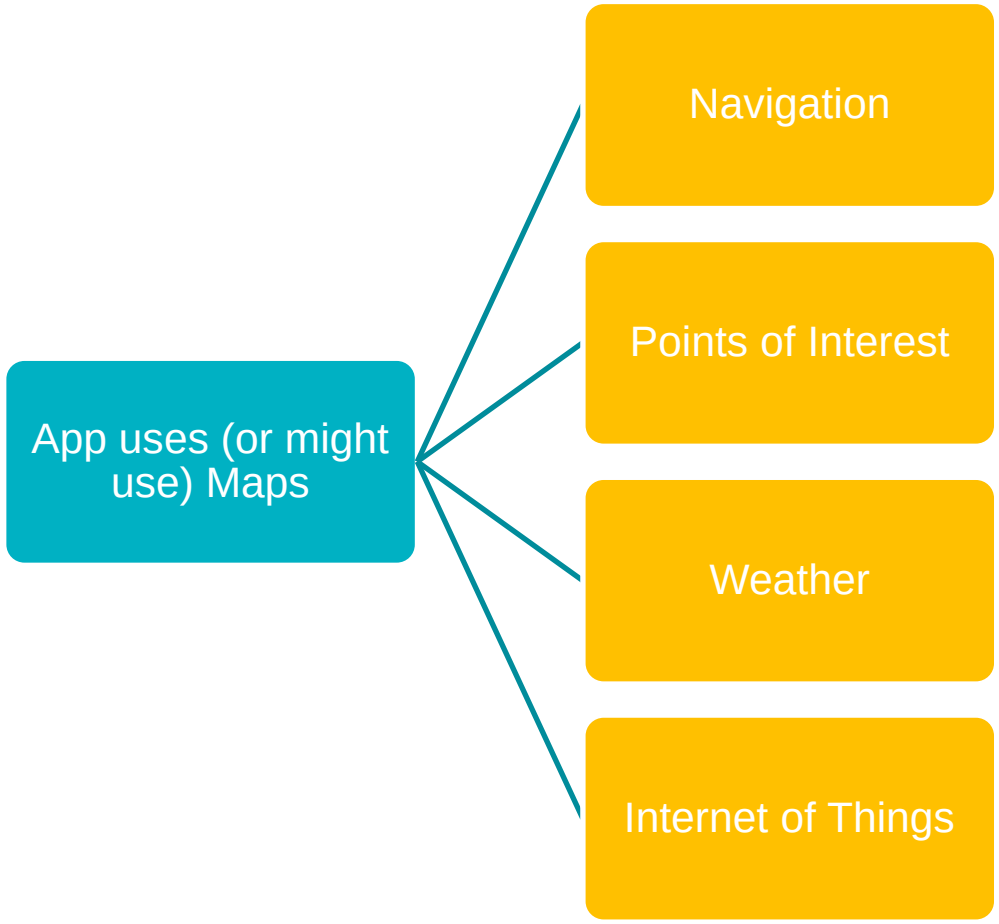
https://developer.android.com/training/cars/apps

PROVIDED BY

- ANDROID
- OEM
- 3RD PARTY

Automotive Host for 3PAs that render maps

Presented
Work in progress



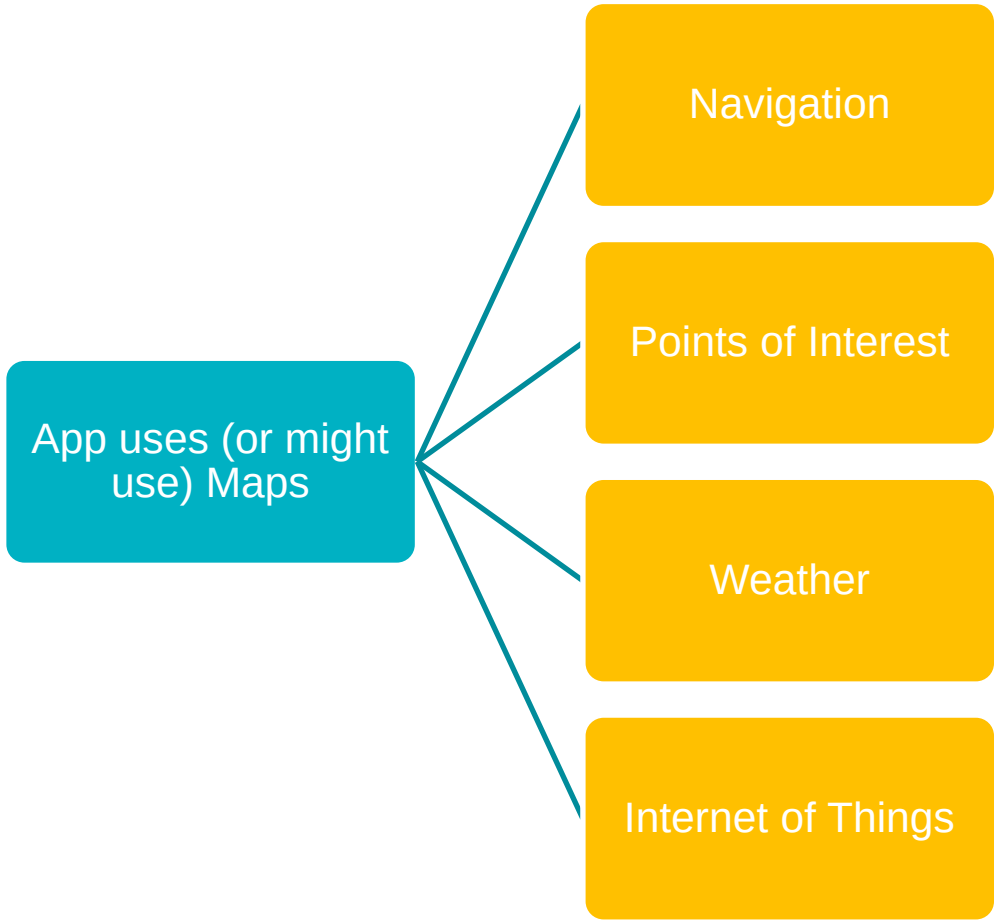
	Map rendered by Host	Map rendered by the App
Navigation		✓
Points of Interest	✓	
Weather	✓	
Internet of Things	✓	

https://developer.android.com/training/cars/apps#supported-app-categories
https://developer.android.com/training/cars#supported-app-categories

COVESA

Automotive Host for 3PAs that render maps

Presented
Work in progress



Automotive App Host needs to be able (among other things) to render maps

https://developer.android.com/training/cars/apps#supported-app-categories
https://developer.android.com/training/cars#supported-app-categories

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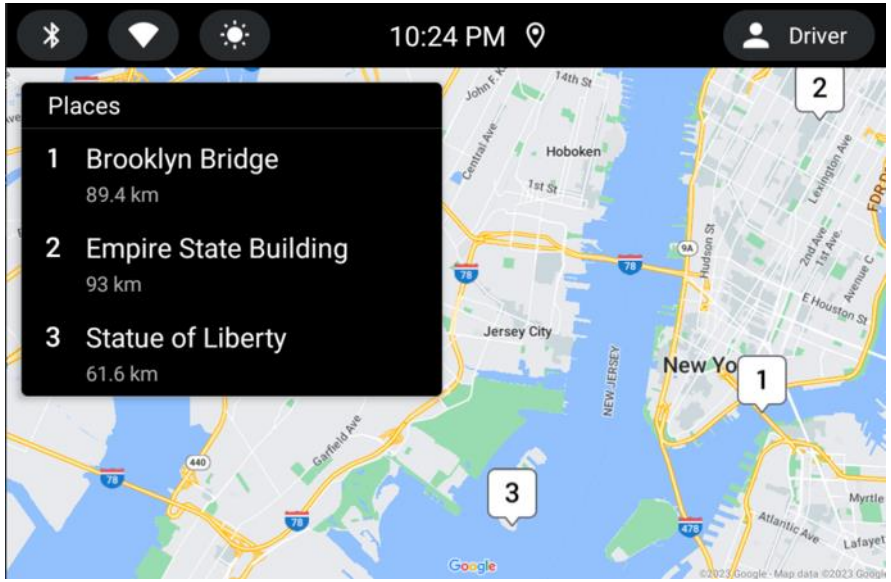
AOSP Automotive App Host

Presented
Work in progress

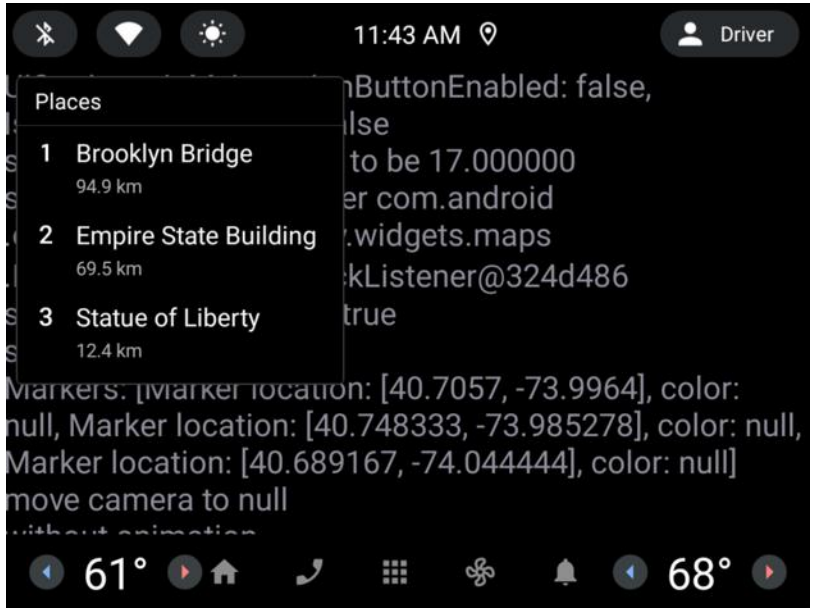
GAS Version (1)



Screenshot from a GAS Emulator, using GAS Automotive Host (with Google Maps), displaying a POI example app

(1) https://play.google.com/store/apps/details?id=com.google.android.apps.automotive.templates.host

AOSP Version (2)



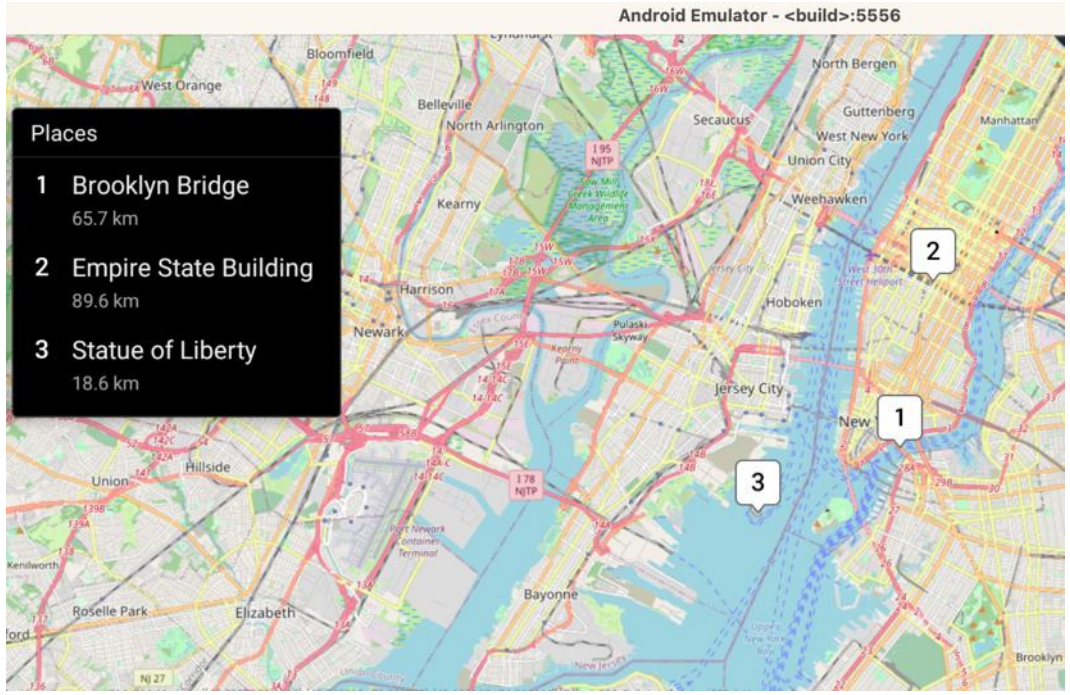
Screenshot from a non-GAS Emulator, using AOSP Automotive Host (without maps), displaying a POI example app

(2) https://android.googlesource.com/platform/packages/apps/Car/Templates/+/refs/heads/master/Host

COVESA (?) Automotive App Host

Presented
Work in progress

COVESA Version (?)



Screenshot from a non-GAS Emulator, using Faurecia Aptoide Automotive Host (with OSM Maps), displaying a POI example app

Next steps:

- Potential COVESA contribution:
- Automotive App Host reference implementation using open source maps (e.g. Open Street Map)
- Use an Interface that Abstracts Maps Provider so that OEMs can easily plug their Maps
- Create a common interface for automotive intents (Multiple Waypoints, Electric Vehicles Trip Plans) based on Google Maps for Automotive Intents
- COVESA or AOSP repository?

OpenStreetMap

https://developers.google.com/maps/documentation/urls/android-intents-automotive

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Presented
Work in progress

Communication Apps

Rely on Cars App library, Push Notifications and Camera interface

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What about Communication Apps?

Presented
Work in progress

App doesn't use Maps — Communication

- Communication/Messaging not yet a category on Android Automotive, likely in the future (Zoom, Microsoft Teams, and Webex by Cisco (*))
- Probably based on **Cars App Library**
- Depend on:
  - **Push Notifications for incoming calls/messages**
  - Camera interface for video Conferencing

Android Push Notifications rely on Google Mobile Services (GMS). A priority to be tackled by COVESA.

(*) https://android-developers.googleblog.com/2023/05/whats-new-with-android-for-cars.html

Presented
Work in progress

Key Takeaways

For Automotive AOSP App Framework Standardization WG

COVESA

Key Takeaways for COVESA Automotive AOSP App WG

- **Top priority**: avoid fragmentation and ensure compatibility (to the possible extent)
  - Make sure Apps publishers can Create Once Publish Everywhere
  - Provide the tools for Apps Publishers to validate their apps
- Specific topics to tackle:
  - Non-GAS Emulators → Tools for Apps publishers to validate their apps
  - Automotive App Host able to render maps (available also on the emulator) → for Apps publishers and also for OEMs
  - Push Notifications → to enable new features needed by Communication apps
  - Camera2 reference implementation → feasibility of Camera2 API for use cases such as video conferencing

FURTHER F2F EVENTS

Paul Boyes, COVESA

COVESA

Accelerating the future of connected vehicles

FURTHER F2F MEETINGS FOR EXPERT GROUP.

- All Members Meeting (AMM) 2x year
  → 1x Europe
  → 1x US
- Option to combine longer working session of expert group with presentations at AMM
  → **To-Do @all:** Check possibility of attendence AMM in Detroit 10th-12th October
  → GM confirmed attendance already
- COVESA Event @ CES: 1x year (next one 09.01.2024, begin afternoon)
  → **To-Do @OEMs/App Store Provider:** Check if joint event 2024 is possible (e.g. joint discussion round/showcasing same apps in different vehicles)
- Further independently organized events
  → **To-Do @all:** Who would be open to host the next onsite event?

MEETING WRAP UP

Melina Mascolo, BMW

COVESA

Accelerating the future of connected vehicles

PARTICIPANTS.

Participants Onsite:

- BMW
- Cariad
- Mercedes
- General Motors
- Faurecia Aptoide
- Elektrobit
- Ansys
- Bosch
- L&T Technologies

Virtual Participants:

- Volvo Cars
- Hyundai Mobis
- General Motors
- Mbition
- BMW
- Ford
- RemotiveLabs
- Luxoft
- COVESA
- Blackberry
- Jimmy Technologies
- Grapeup
- Mavi.io
- LGE