



# Introduction to Automotive Grade Linux

*Automotive Linux Summit*

*June 20, 2018*

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*Community Manager, [AGL](#), [The Linux Foundation](#)*

# Automotive Grade Linux

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*Collaborating to build the car of the future through rapid innovation*

[\*http://AutomotiveLinux.org\*](http://AutomotiveLinux.org)

# What is AGL?

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- Non-profit
- Open source Linux-based collaborative project
- Hosted at Linux Foundation
- Focused on rapid innovation of vehicle software

# Goals of AGL

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- Build a single software platform for the entire industry
- Develop 70-80% of the starting point for a production project
- Reduce fragmentation by combining the best of open source
- Develop an ecosystem of developers, suppliers, expertise all using a single platform

# AGL Members - Total of 127 companies!

## Platinum



## Gold



## Silver



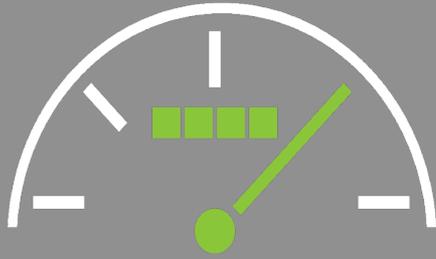
## Bronze



# 19 New AGL Members in 2018



AGL MEMBERSHIP LIST 2018



# AUTOMOTIVE GRADE **LINUX**

the only  
organization  
addressing  
all software in  
the car



Infotainment



Instrument  
Cluster



Heads-up  
Display (HUD)



Telematics/  
Connectivity



Functional  
Safety



Advanced Driver  
Assistance Systems  
(ADAS)



Autonomous Driving

# AGL is CODE FIRST

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***AGL is a “Code First” organization!  
Specifications lead to fragmentation!***

# Thanks for all the fish...

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- AGL Releases:

AA – Agile Albacore – Jan 2016



BB – Brilliant Blowfish – July 2016



CC – Charming Chinook – Dec 2016

DD – Daring Dab – July 2017

EE – Electric Eel – Jan 2018



FF – Funky Flounder – July 2018

GG – Grumpy Guppy – Jan 2019



# Top 25 Git Committers in 2018

Commits	Name	Company
141	Jose Bollo	IoT.bzh
76	Matt Ranostay	Konsulko
71	Changhyeok Bae	LG
68	Romain Forlot	IoT.bzh
67	Khang Nguyen	Renesas
51	Ronan Le Martret	IoT.bzh
39	Thuy Tran	Renesas
31	Jan-Simon Moeller	Linux Foundation
31	Kazumasa Mitsunari	Witz
28	Jonathan Aillet	IoT.bzh
18	Thao Nguyen	Renesas
15	Kevin Hilman	BayLibre
15	Loic Collignon	IoT.bzh

Commits	Name	Company
13	Sebastien Douheret	IoT.bzh
11	Martin Kelly	Xevo
11	Matt Porter	Konsulko
9	Harunobu Kurokawa	Renesas
9	Kotaro Hashimoto	Mitsubishi Electric
7	Loys Ollivier	BayLibre
7	Stephane Desneux	IoT.bzh
7	Tadao Tanikawa	Panasonic
7	Tobias Jahnke	Microchip
7	Tom Rini	Konsulko
5	Christian Gromm	Microchip
5	Scott Murray	Konsulko
5	Thierry Bultel	IoT.bzh

796 Total Commits  
47 Committers  
19 Companies

- 01 Jan 2018 – 14 June 2018
- Commits to master

# Commits by Company in 2018

Company	Commits
IoT.bzh	329
Renesas	140
Konsulko	106
LG	71
Witz	33
Linux Foundation	31
BayLibre	25
Microchip	12
Mitsubishi Electric	11

Company	Commits
Xevo	11
Panasonic	7
Intel	5
FiberDyne	4
Individual	3
Qt Company	3
Nexty	2
AisinAW	1
Cogent Embedded	1
Virtual Open Systems	1

796 Total Commits  
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- 01 Jan 2018 – 14 June 2018
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# Other Numbers

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- 137 commits to eel release branch in 2018
- 5 commits to dab release branch in 2018
- 101 unique individuals and 36 unique companies have contributed to AGL since the start of the project
  - 11 New committers in 2018
- 11 individuals not affiliated with a member company have contributed
- 192 Jira issues closed during 2018
  - 1082 issues closed since start of project

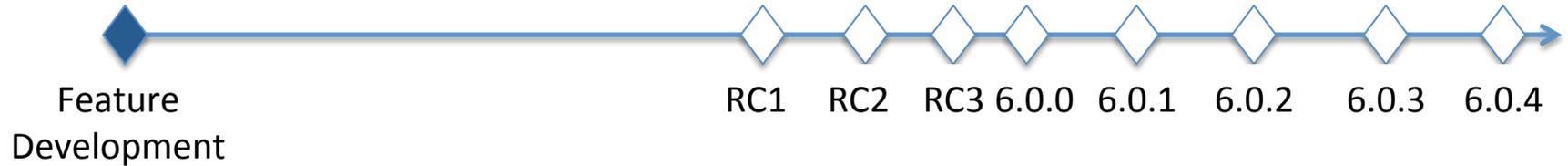
# 2018 AGL Schedule



## Electric Eel



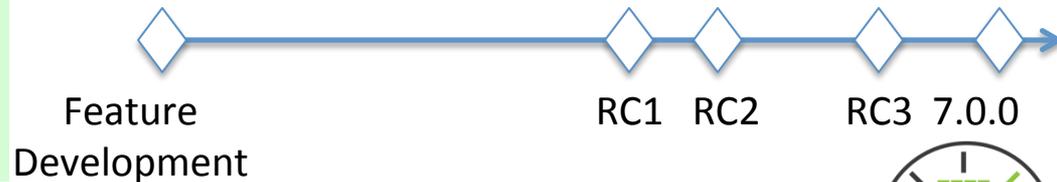
## Funky Flounder



See

[https://wiki.automotivelinux.org/schedule#latest\\_schedule](https://wiki.automotivelinux.org/schedule#latest_schedule) for latest schedule information

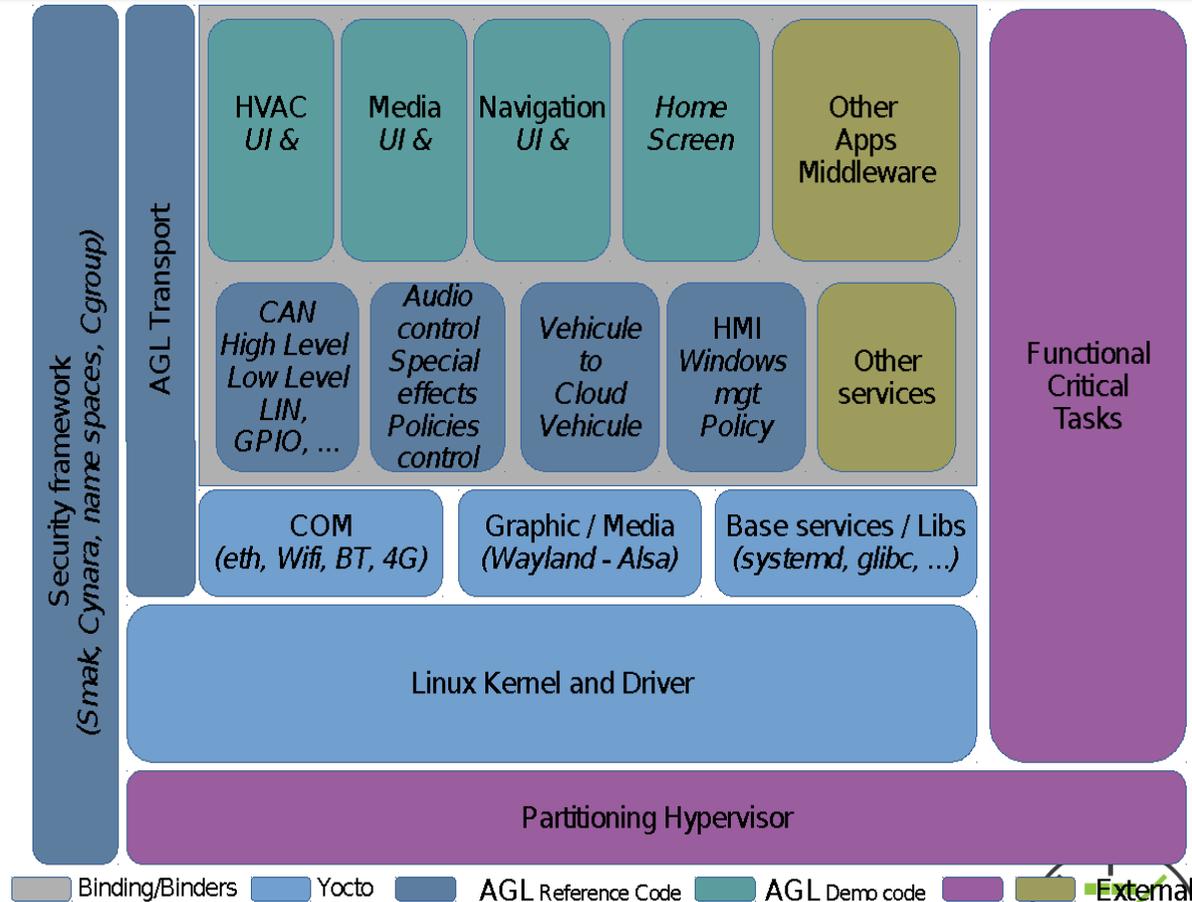
## Grumpy Guppy



# AGL Architecture

## Platform

- Base BSP
- Security
- AGL transport
- **Micro Services based**
- Middleware and App Binding / Binder Model
- Downloaded on platform
- Multi-ECU
- Car to Cloud
- Car to Car



# AGL Binder/Binding

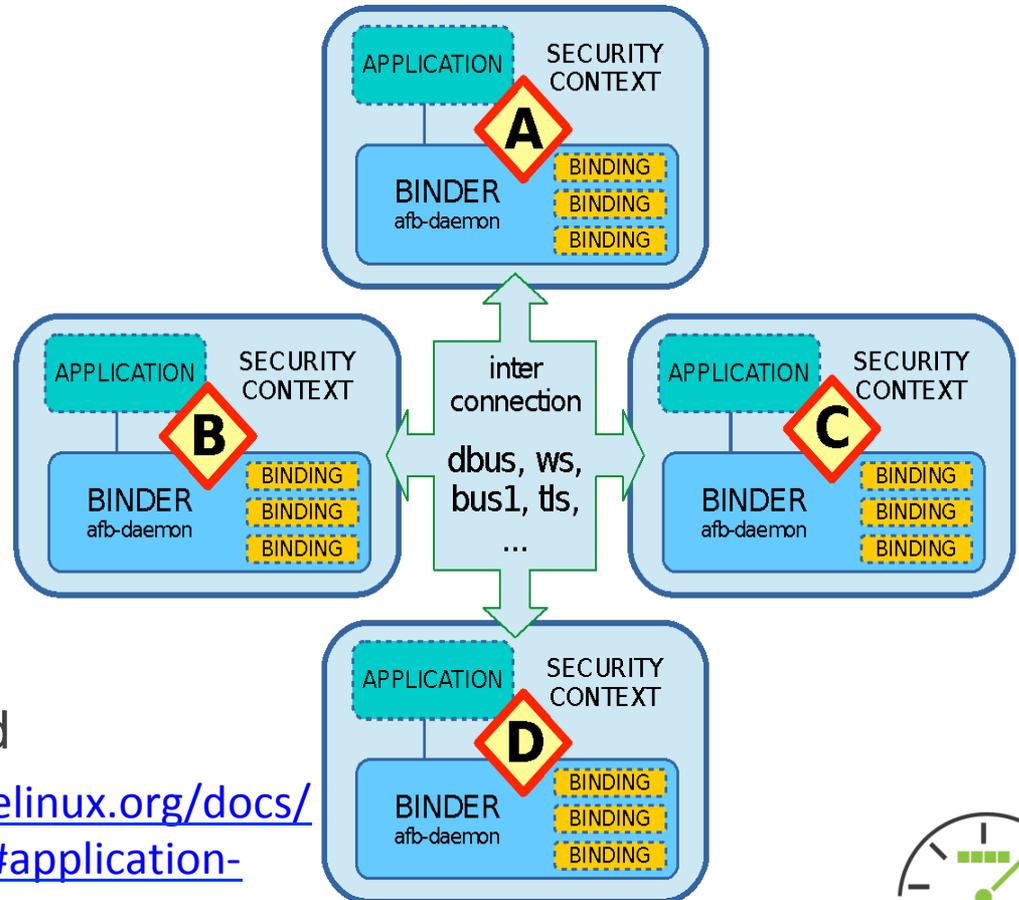
## Binder

- Container process
- Transport
- Security
- Standardized Async API structure

## • Binding

- Library called from a binder
- Implements feature
- Multi thread support
- Standardized integration
- Reference example provided

[http://docs.automotivelinux.org/docs/apis\\_services/en/dev/#application-framework-binder](http://docs.automotivelinux.org/docs/apis_services/en/dev/#application-framework-binder)



# SDK for App Developers

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- Docker image to eliminate host dependency issues
- Available for reference boards with published images that include graphics drivers
- Enables rapid AGL application development  
Support for Qt (HTML5 coming!)
- No Yocto knowledge is needed or assumed for SDK users

<http://docs.automotivelinux.org/docs/devguides/en/dev/#development-kit-build-agl-application>

# Vision for 2018

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- Major Content Providers Develop AGL Apps
- OEMs Port Legacy Apps to AGL
- Releases
  - Funky Flounder - July 2018
  - Grumpy Guppy - January 2019

# Vision for 2018

- AGL App Framework Evolution
  - User Management
  - Power Management
  - Memory and CPU management
- Home Screen and Window Manager Services Complete
- Chromium based HTML5 Apps

# Vision for 2018

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- Production Ready Audio Solution
- Video Player Reference App
- Vehicle to Cloud Services
- Speech and Text to Speech Services
- Expanded AGL Automated Test Suite

# DEVELOPER RESOURCES

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# AGL Documentation

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- Getting Started

<https://wiki.automotivelinux.org/start/getting-started>

- AGL documentation site

<http://docs.automotivelinux.org/>

- AGL Wiki

<https://wiki.automotivelinux.org/>

- AGL Jira

<https://jira.automotivelinux.org/>

# Get The Code

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- Pre-built binaries and source tar balls available
  - <https://www.automotivelinux.org/software/download>
- Latest Source Code and Build Instructions
  - <https://wiki.automotivelinux.org/agl-distro/source-code>
- Release Notes
  - <https://wiki.automotivelinux.org/agl-distro/release-notes>

# AGL Code

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- AGL gerrit

<http://gerrit.automotivelinux.org/>

- AGL git

<https://git.automotivelinux.org/>

- Weekly Developer Call - Tuesdays

<https://wiki.automotivelinux.org/dev-call-info>

# 2018 F2F Workshops

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- Feb 19- 21 – AGL AMM – [Tokyo](#)
- Apr 12 – 13 – [Karlsruhe, Germany](#) (Microchip)
- June 5 – 8 – [Lorient, France](#) (IoT.bzh)
- June 19 – Day before Automotive Linux Summit - [Tokyo](#)
- Early Sep? – Santa Clara (LG Office)
- October 15 – 18 - [Fall AMM](#) – Dresden, Germany
- Nov 6-8 – [CES Integration Session](#) – Yokohama
- Dec 4-6 – CES Integration Session - Yokohama

# GETTING INVOLVED – EXPERT GROUPS

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# EXPERT GROUP UPDATE

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# Active Expert Groups

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- Application Framework and Security
- Connectivity
- Continuous Integration and Automated Test
- Graphics and UI
- Navigation
- Virtualization
- Reference Hardware System Architecture
- Speech
- Vehicle to Cloud

# App Framework and Security EG

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- *Application lifecycle (install, run, remove, applications)*
- *SDK and application developer experience both in security and APIs*
- *Security framework, policies, and strategy for the distribution*
- *Network and vehicle firewalls in conjunction with the Connectivity EG*
- *Software Update and secure update*
- Diagnostic log and trace
- Secure boot

<https://wiki.automotivelinux.org/eg-app-fw>

# App Framework Accomplishments

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- AGL App Framework Available
- AGL Reference Apps available for both Qt5
- APIs available as App FW Service Binders
- SDK with XDS Available
  - App Templates and developer guide
  - Widget creation
  - Service Binders with developer guide

# App Framework Accomplishments

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- Security Blueprint Revision Published
- API V3
  - Dynamic API creation
  - Service Binder Discovery

# App Framework Tasks

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- Change to run as non-root/ Multi-user
- Improved debug capabilities
- Speech Enablement
- HTML5 App Management
  - XDG Launcher
  - App Updates
  - Privacy and Security
- Security workflow for Device and App developers

# Connectivity EG

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- *Vehicle Connectivity (CAN, MOST, LIN)*
- *Network and vehicle firewalls*
- *Bluetooth, Wifi, NFC*
- Smart Device Link (SDL)

<https://wiki.automotivelinux.org/eg-connectivity>

# Connectivity Accomplishments

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- Bluetooth
  - Existing binders refactored for improved stability and responsiveness
  - PBAB binder available
- Wifi binder refactored
- Telephony binder new features
- Vehicle messaging
  - Signal composer stabilization and improvements
  - API to define new virtual messages at run-time

# Connectivity Task List

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- Network management binding
  - Connman improvements or replacement
  - IPv4/v6 configuration
  - Network Bridging, Tethering, QOS and switching
  - User profiles to allow authorized users to configure interfacing
  - Support multiple low-level interface binding backends including Ethernet, WiFi, BT PAN, and WWAN

# Connectivity Task List

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- Signal composer stabilization and improvements
  - Ready to Extend beyond CAN
  - Factory programming of CAN message set based on final vehicle configuration

# Connectivity Task List

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- Wifi binder
  - AP Mode
  - Additional Wifi hardware support
- Telephony binder
  - Extend to hardwired telephone use case
- NFC binder and NFC for user identification

# CI and Automated Test EG

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- *Build and smoke test of Gerrit submissions on all hardware*
- *Daily snapshot build and testing*
- *Device tests on real hardware*
- *Test environments such as JTA and Lava*
- Test suites such as LTP

<https://wiki.automotivelinux.org/eg-ciat>

# UI and Graphics EG

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- *AGL Compositor, Layer Manager, Window Manager and GPU interface*
- *Multimedia video manager (including multi-display and display sharing) and audio manager, and media manager/player.*
- Browser Engine

<https://wiki.automotivelinux.org/eg-ui-graphics>

# Graphics and UI Accomplishments

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- Update to Wayland 2.0
- Refactored Home Screen including splitting out Window Manager
- XDG Launcher started
- Internode display protocol
  - Control IC display output from navi running on IVI system
  - Waltham
- Support for Chromium browser engine

# Graphics and UI Accomplishments

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- Improved Audio management configuration and policies
  - High Level audio API
  - AGL Advanced Audio Agent (AAAA)
  - UNICENS binder
  - HALs available for UNICENS, USB audio, Renesas and Intel on-board audio

# Graphics and UI Tasks

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- Finish Window Manager and Homescreen work
  - Pop-up support and interactive user response
  - Focus management for out of focus apps
  - Improved secondary display support
  - Transition Animation
  - Hardware plane management
- Production ready audio implementation

# Navigation EG

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- Navigation API
- Location Based Services API
- Reference Navigation and POI apps
- Speech recognition integration

<https://wiki.automotivelinux.org/eg-navi>

# Navigation Accomplishments

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- Navigation and POI reference Apps
- GPS, Geofence binder available

# Navigation Task List

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- Navigation API 1.0 fully implemented
- GPS binder available
- Map creation process
- New Navi app from Comtech

# Virtualization EG

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- Hypervisor/ LXC
- Looking at Xen, Jailhouse, and others

<https://wiki.automotivelinux.org/eg-virt>

# Virtualization Accomplishments

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- Automotive Virtualization White Paper Completed
- Several CES demos ran in virtualized environments (Panasonic, Denso, EB, etc.)

# Virtualization Task List

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- Standard Protocol for communications between VMs
- Resource sharing (e.g. GPU) between VMs
- Extend KVM support beyond Renesas
- Additional open source hypervisors

# Reference Hardware System Arch

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- Create system architecture to be used across AGL profiles

# Speech EG

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- Members: Amazon, Nuance, VoiceBox Technologies
- Create a standardized set of speech recognition APIs that app developers can use regardless of underlying speech engine
  - Natural language or grammar tree based
  - On board or cloud based speech
- Text to Speech API
- Amazon and Nuance have open APIs that could be used as a starting point
  - Nuance started on a Speech API Binding that is being reviewed by the team

# Speech EG

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- Signal processing for noise reduction and echo cancellation
- Grammar development tools

# System Architecture Team

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- Overall System Architecture
- Yocto
- Build system and Device Profiles
- Cross EG coordination

# V2C Expert Group - Objectives

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- Refine V2C Use Cases
  - Telematics
  - Personalization
  - Authentication & Authorization
  - Etc.
- Define Reference Architecture
  - Identify existing, missing or reusable components
- Identify reference application(s)



Q & A

# Q & A

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- This is the segment where
  - You ask intelligent, well thought out questions
  - I ramble pointlessly and unintelligently
- And/Or
  - You ask “dumb” questions
  - I respond with concise, insightful, and well-reasoned answers



**THANK YOU**