

## Enabling Technologies

### Summary of Meeting Agenda:

- Explore a wide range of technologies needed to establish automated vehicles.
  1. Position, Localization and Mapping
  2. Algorithms, deep learning techniques, sensor fusion, guidance and control.
  3. Hybrid communications
  4. Sensing and perception
  5. Technologies for data ownership and privacy
- Gain an understanding of how these technologies will need to work together to address needs of the applications, with recognition of data ownership, regulatory and standardization perspectives.
- Realize the potential shortfalls in these technologies, ranging from pure technical capabilities through the conformance to the perspectives listed above.

### Organizers:

- Jim Misener, Director, Technical Standards, Qualcomm Technologies Inc
- Cristofer Englund, Research Manager, Viktoria Swedish ICT
- John Estrada, CEO eTrans Systems
- Juhani Jaaskelainen, Consultant
- Frank Serna, Principal Director, Strategic Initiatives, Draper Laboratory
- Surya Satyavolu, CEO, Sirab Technologies
- Sudharson Sundararajan, Lead Technologist, Booz Allen Hamilton

USERS. VEHICLES. INFRASTRUCTURE.

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### Summary of Key Findings/Lessons Learned from Breakout Discussion

- Opportunities for Synergy
  - Maps, positioning and the infrastructure: crowdsourcing (of course), road features (inserting more infrastructure for localization)
  - Hybrid communications for difficult use cases (collaborative driving, long and short range)
    - Collaborative perception, localization
    - Use of mobile edge computing
- Perspectives of Deep Learning
  - Enables use of low cost sensors
  - Can leverage tremendous computational resources (Watson)
- Data ownership and privacy are essential engineering and policy considerations

#### Potential Deployment Scenarios

**1 Required Connected Capability** - A large western country decides that as of 2019 all newly manufactured vehicles must come with connected vehicle safety technology and that within a span of several phase-in years all cars must be equipped or retrofit with the capability.

**2 Retirement Community** - A small town (about 20,000) which is mostly a wealthy retirement community mandates that on a certain date that vehicles registered and traveling within the city limits must be autonomous vehicles.

**3 Mandated Platooning** - In 2020, The US government mandates platooning trucks or automated vehicles only in the far left lane for large sections of the US interstate highway system.

**4 Small City Taxi Service** - A large corporation in conjunction with a medium size city, about 400,000, launches a driverless taxi service to service the entire metropolitan area.

**5 AVs in Hot Lanes** - A large state plans to modify its hot-lanes so that to incentivize AVs, for example, providing specific time windows for AVs and offering free or reduced access fees. Initially the incentives are limited by taking into account the market penetration but they are expected to expand over the next couple of years until they become 24/7 for AVs.

**6 Delivery Platooning** - In 2018, a large Nationwide US package delivery service deploys platooning technology (NHTSA Level 1 or 2 and Connected Vehicle technology) to its cross country fleet and starts organizing platoons. It has previously received government approval to optimize the work rules surround platooning truck drives.

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Primary Recommended Action Item: Need bigger room and/or comfy floors. Need better HVAC.



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## Recommended Action Items:

- Record 'snapshot' of contemporary research directions and emerging results
- Future: To do a better job, we need to:
  - Do a deeper dive (two days?)
  - Explore and catalog synergisms between enabling technologies