

# The Storage/Management Challenges of the Autonomous Transportation Ecosystem

Alan Messer, Ph.D.

[alan@innovationshift.com](mailto:alan@innovationshift.com)

*CEO InnovationShift - AI/Autonomous/IoT Consultancy*

*CTO, Mojo Inc. - Leading Connected Car SaaS vendor*

*Advisor - Microsoft AI Advisory Board*

*Advisor - DAV Alliance*

*Former CTO of Connected Car at General Motors*

*Former Head of Advanced Software at Samsung*

# Autonomy and Safety Overview

- Many types of Autonomous Vehicles are being considered
  - Each has limitations
  - Varying levels of storage and safety needs
- In addition, storage and safety needs are end-to-end
  - Car
  - Cloud Services
  - Connectivity in-between
- And must be high performance and automotive grade

# Data/Storage: L3 Highway/Consumer

Driver must pay attention at all times

- Hands on the wheel (L2):
  - Most 'semi-autonomous' products in market
  - E.g. Tesla Autopilot, OEM ADAS features
- Hands off the wheel (low L3):
  - Highway only
  - E.g. GM SuperCruise, Audi ProDrive



## *On-vehicle:*

- Local processing camera, radar, ultrasonic
- Local HD mapping storage
- Storage for accidents/logging

## *Cloud:*

- HD mapping storage
- Analytics data processing/collection
- OTA Updates

# L2/L3 Safety Requirements

Rigorous Testing

Rigorous Security

Fail-safe driver takeover

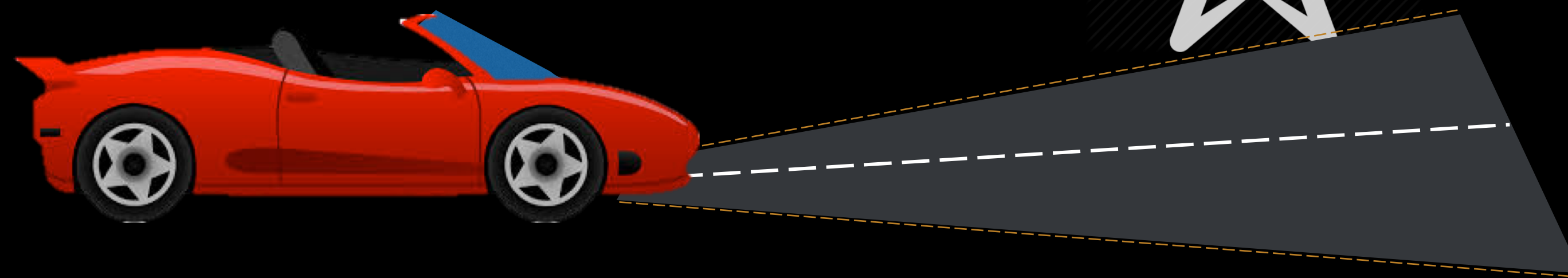
Redundant Sensors

Redundant Processing (Opt)

Storage Failure → disabled function

Redundant Clouds

Redundant Storage for HD Maps



# Data/Storage: L4 Robotaxis/Fleet

Taxi with no human driver (you ride in the back)

- E.g. Waymo, Zoox
- On-road 2019 onwards
- Operate only in pre-defined regions



## *On-vehicle:*

- LIDAR, 8+ cameras, radar, ultrasonic
- High performance on car compute
- Ultra HD LIDAR mapping storage
- Storage of past decisions
- Storage for accidents/logging

## *Cloud:*

- AI infrastructure for ML training
- Big data infra for LIDAR mapping
- Long-term storage for accidents/learning
- Simulation storage and processing

# L4 Robotaxi/Fleet Safety Requirements

Millions of Miles for Validation

Fail-safe Vehicle Stop

Rigorous Security

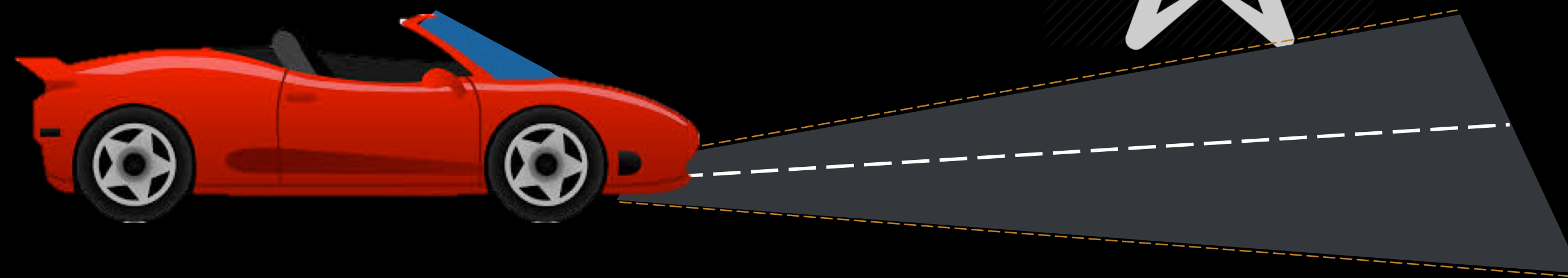
Redundant Sensors

Redundant Processing

Redundant Buses

Redundant Storage

- Machine models
- Mapping
- Compute



Redundant  
Connectivity



Rigorous Security  
Redundancy: Edge and Clouds  
Redundant Vehicle Take Over



# Data/Storage: L4 Consumer

## Hands off the wheel vehicles

- MY2023 plans from traditional OEMs
- Typically highway or suburban regions

## Two approaches:

1. \$\$\$ larger version of L4 Robotaxi
2. Machine-vision-centric



## *On-vehicle:*

- Camera-centric local processing with LIDAR, radar, ultrasonic
- HD Mapping storage for localization
- Storage of past decisions storage
- Storage for accidents

## *Cloud:*

- Video/Image data processing/collection
- Very large AI infrastructure for training
- Big data infra for HD mapping
- Long-term storage for accidents/learning

# L4 Consumer Safety Requirements

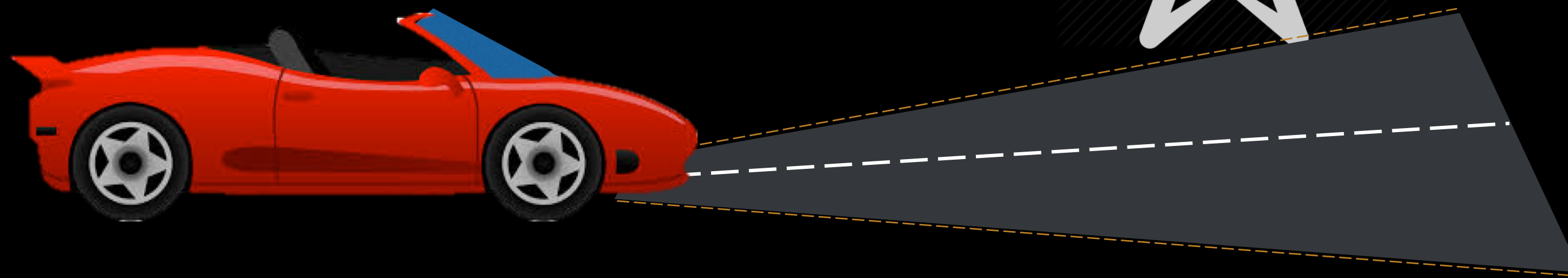
## L4 Robotaxi Plus:

- Components must have a lifetime of 11+ years
- Possible need for Expandability
  - Cheap servicability

Redundant  
Connectivity



Rigorous Security  
Redundant Edge and Clouds  
Consumer Likely To Take Over





# Overarching Challenges

- OEMs need solutions for these vehicles now
  - Due to vehicle time-to-market
- OEMs largely need these through Tier1 suppliers
- All vehicle components must be:
  - Automotive grade: heat range, vibration, etc.
  - Have long lifetimes for fleet maintenance or consumer situations
- Price/performance key to getting volume on these use cases
  - Pressure for consumer technologies at automotive grade

# Summary

- Storage, safety and redundancy vary a lot
  - Depend on the use cases as well as SAE Levels
- Automotive demands extra requirements on hardware
- But they want great price/performance