



# The Fully Networked Car

## Trends in Car Communication

Geneva  
March 2, 2005

# Is The Connected Car Really A Major Business Opportunity?

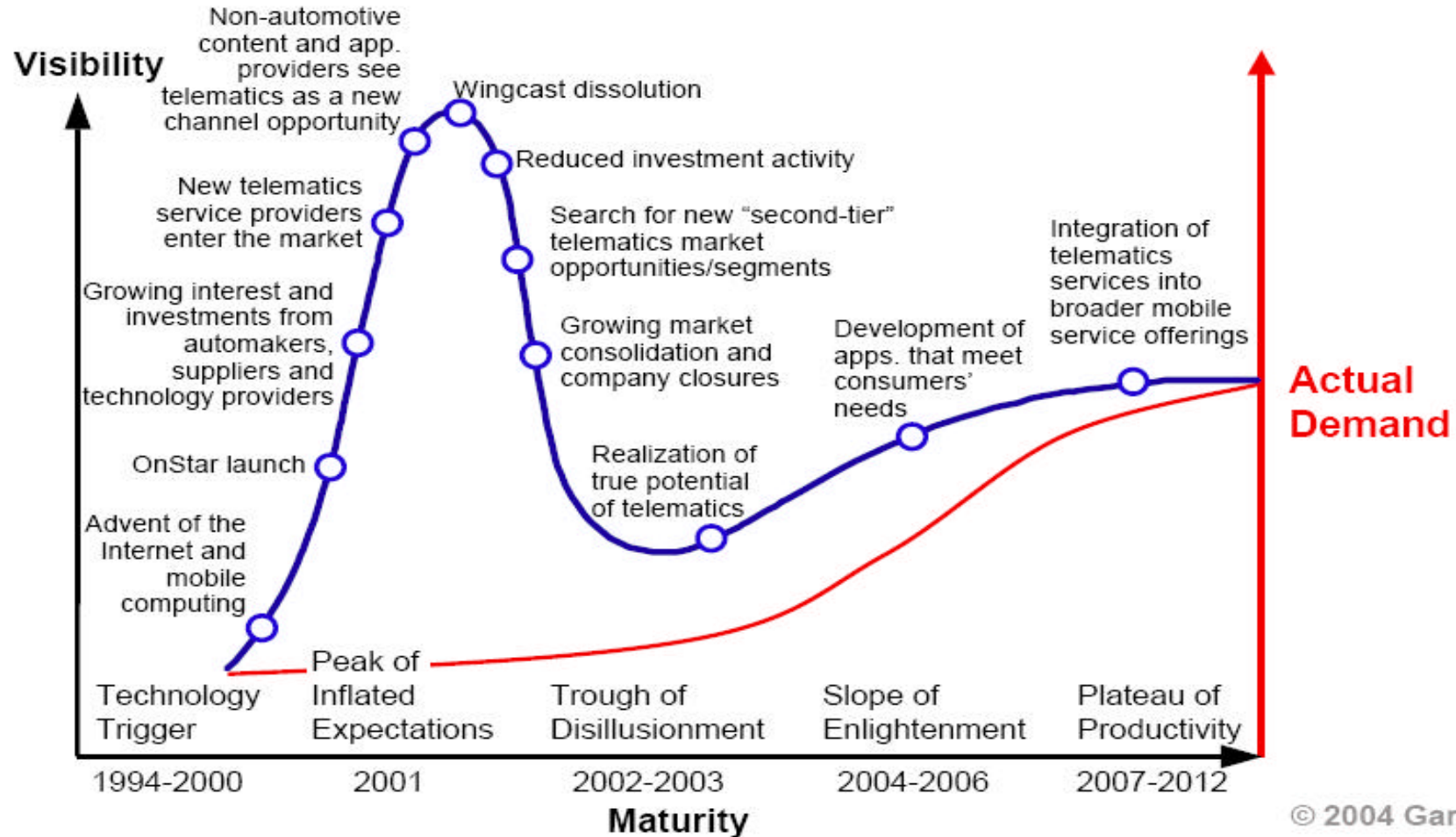




# Are We Flushing Money Away Having No Convincing Customer Benefits?



# Or Is It True That Services / Content Are Aligning With Customer Needs?

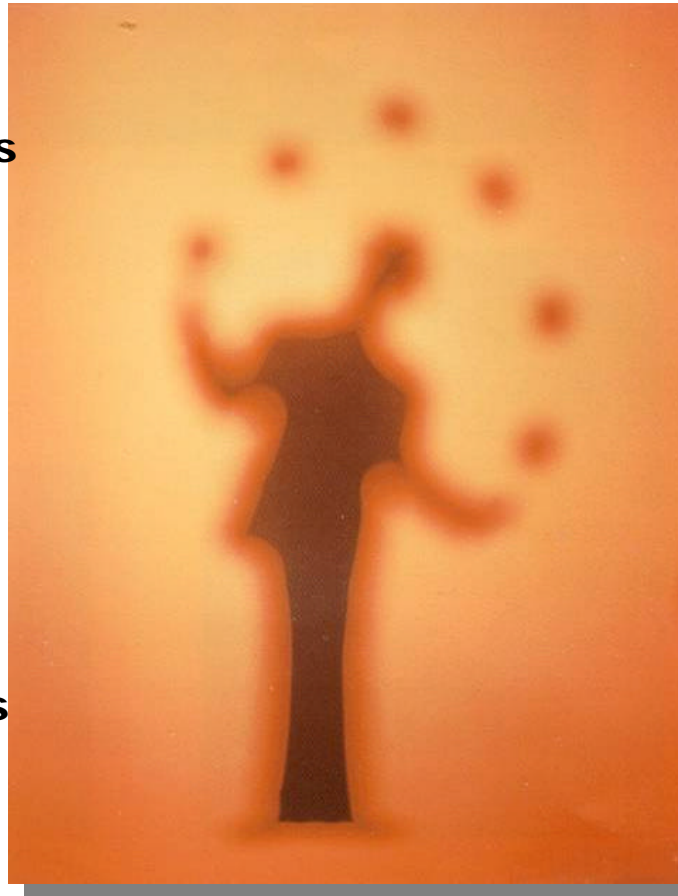


# A Lot Of Questions Remain Open ...



## DEMAND

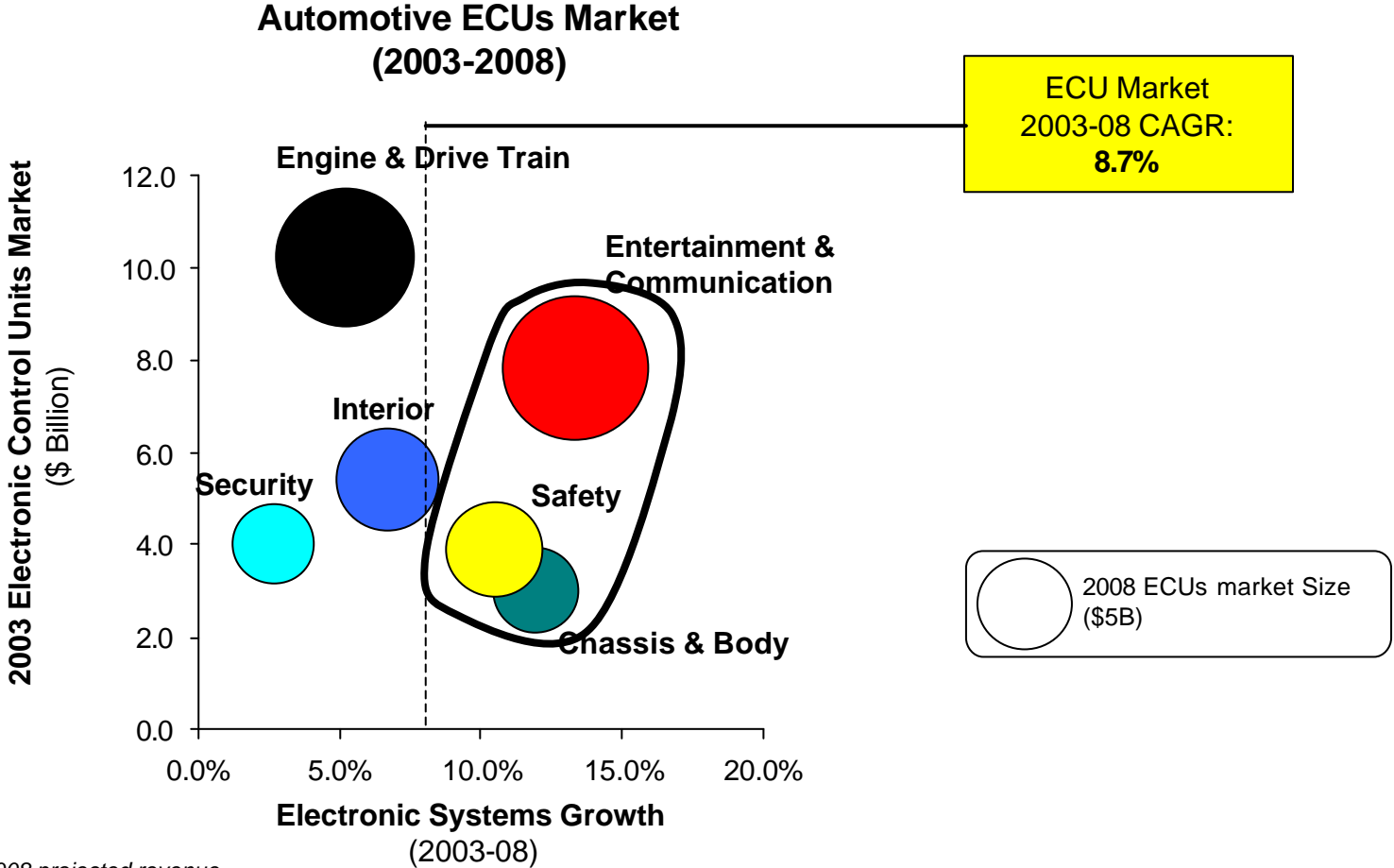
- Consumers' unwillingness to pay – hardware cost and subscription cost
- Closed system locking content and service provider choice
- Inability to port consumer electronics experience to the car environment
- Lack of killer applications
- Privacy issues



## SUPPLY

- Cost of service mostly exceeding revenue
- No convincing business model
- Reluctance of telcos to engage
- OEMs trend to reduce electronic content
- Question as to whether telematics is a source of competitive advantage
- Can we control the vehicle architecture?

# Anyway It Goes, Car Electronics Will Grow Driven By Safety & Comfort



NB: Bubble size proportional to 2008 projected revenue  
 Source: Strategy Analytics, Magna, CTA Consulting Analysis

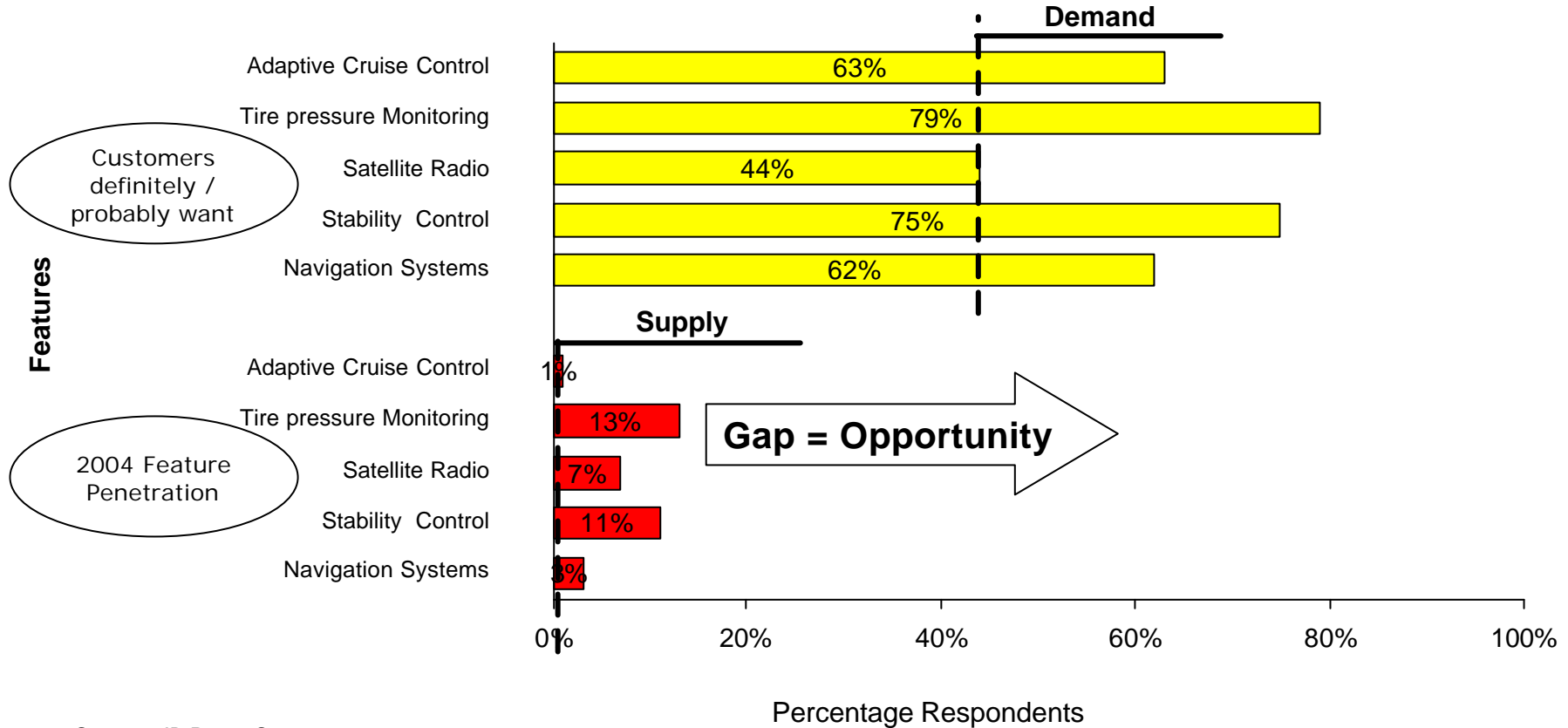




# Demand Numbers Confirm The Trend



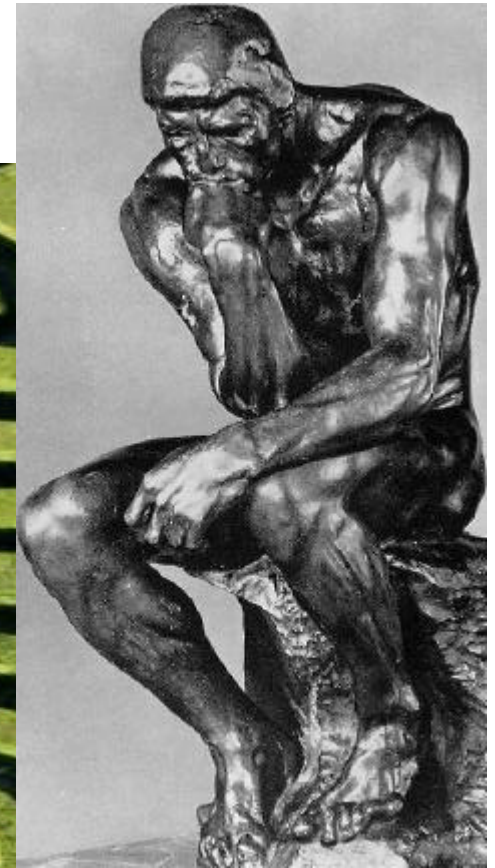
Sample Connected Cars Features: Consumer wants v. Penetration



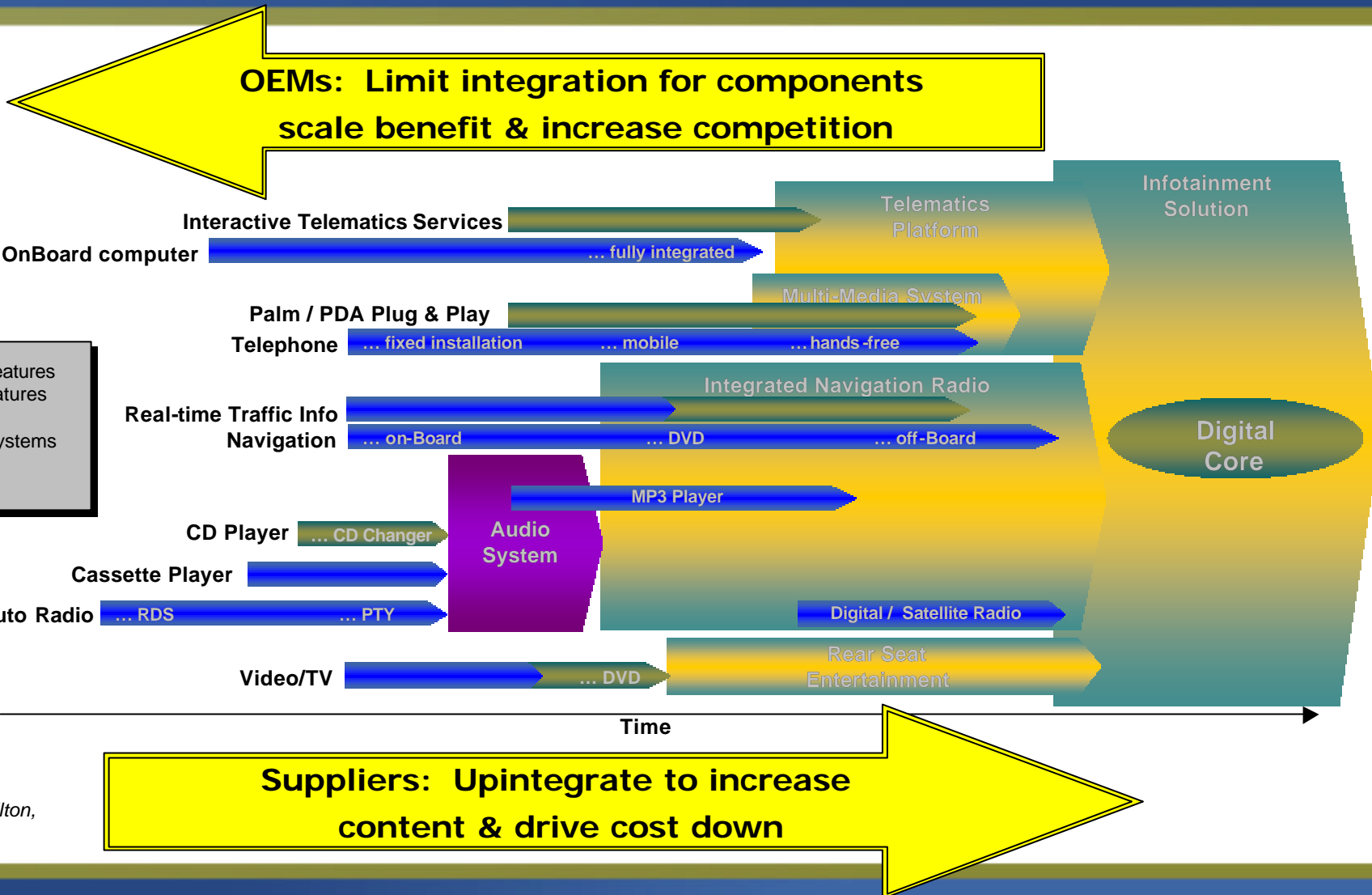
Source: JD Power Survey



# Are We Heading Towards A Major Crisis In Vehicle Electronics?



# Electronic Integration: The bitter sweet!



Source: Booz Allen Hamilton, CTA Consulting

# User Interface: Is The Consumer Bound For Pilot Training?

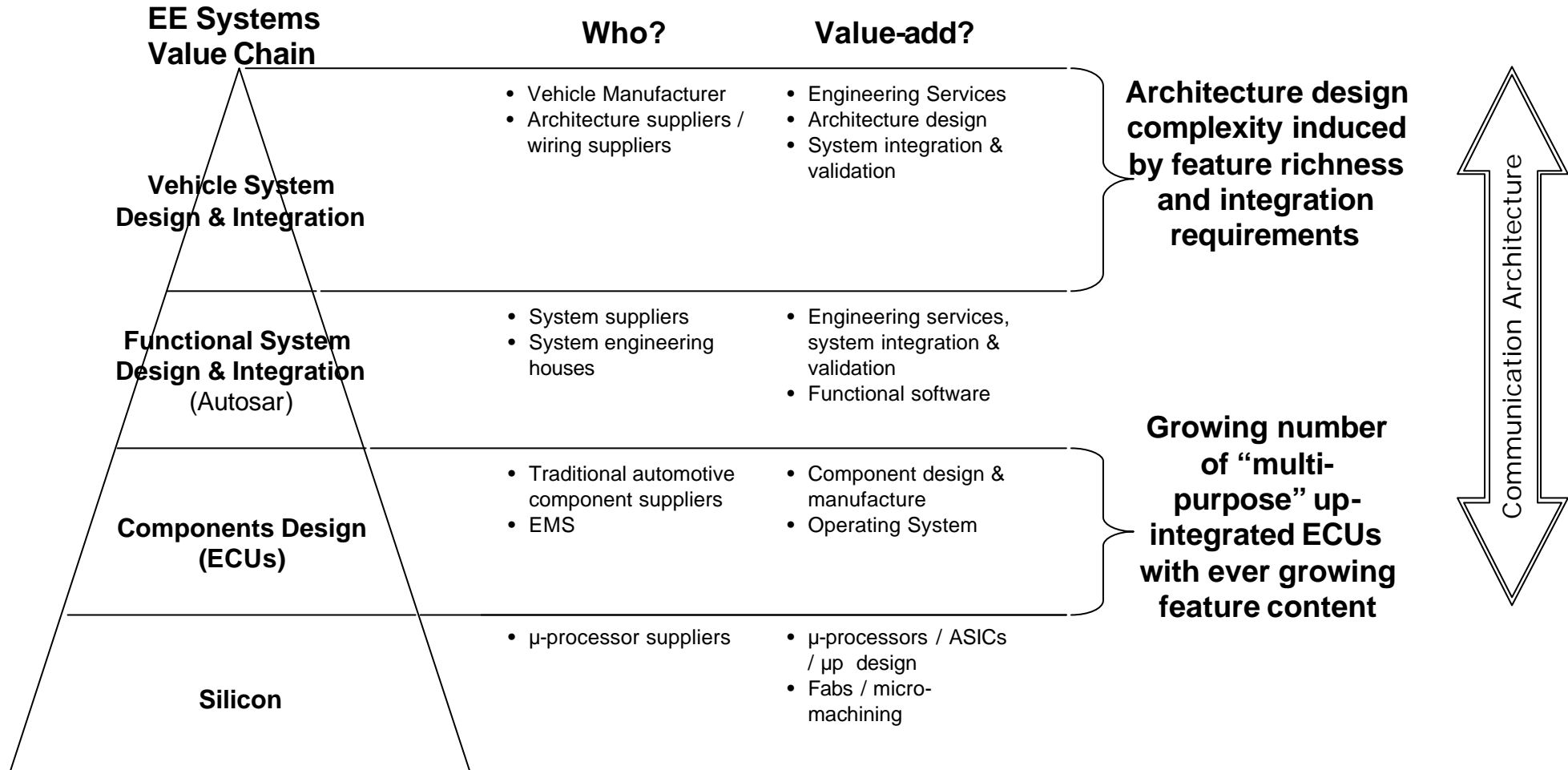




# Dealing With Complexity = Redefine Architecture – Particularly Communication



## Automotive EE Value Chain: Roles & responsibilities





# A New Architecture Paradigm Is Needed



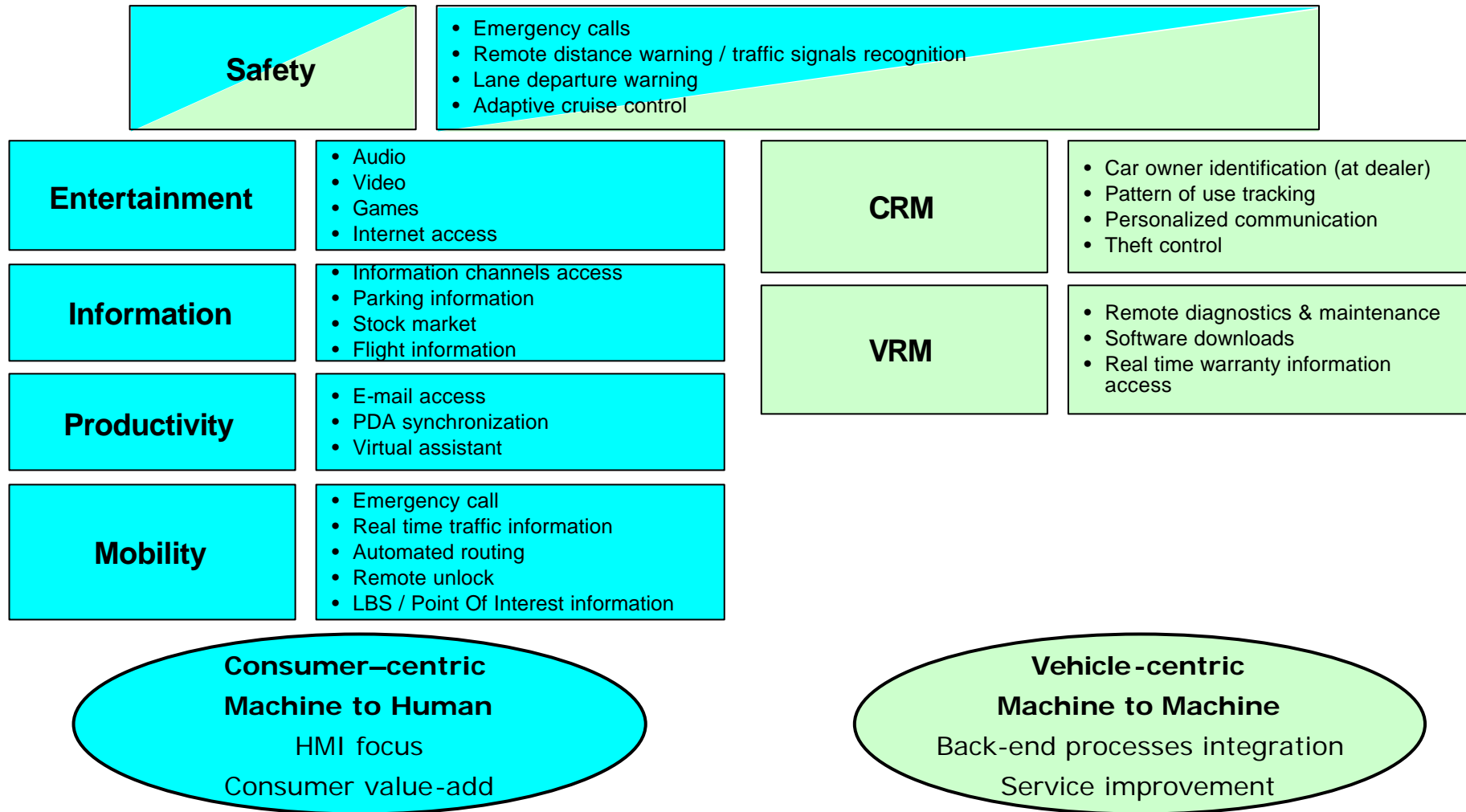
- Standardize for flexibility & scale
- Partition & integrate
- Leverage communication technologies
- Think lifecycle management
- Implement a holistic Vehicle Communication

# Shift The Proprietary Approach Paradigm To Open Standard Architecture

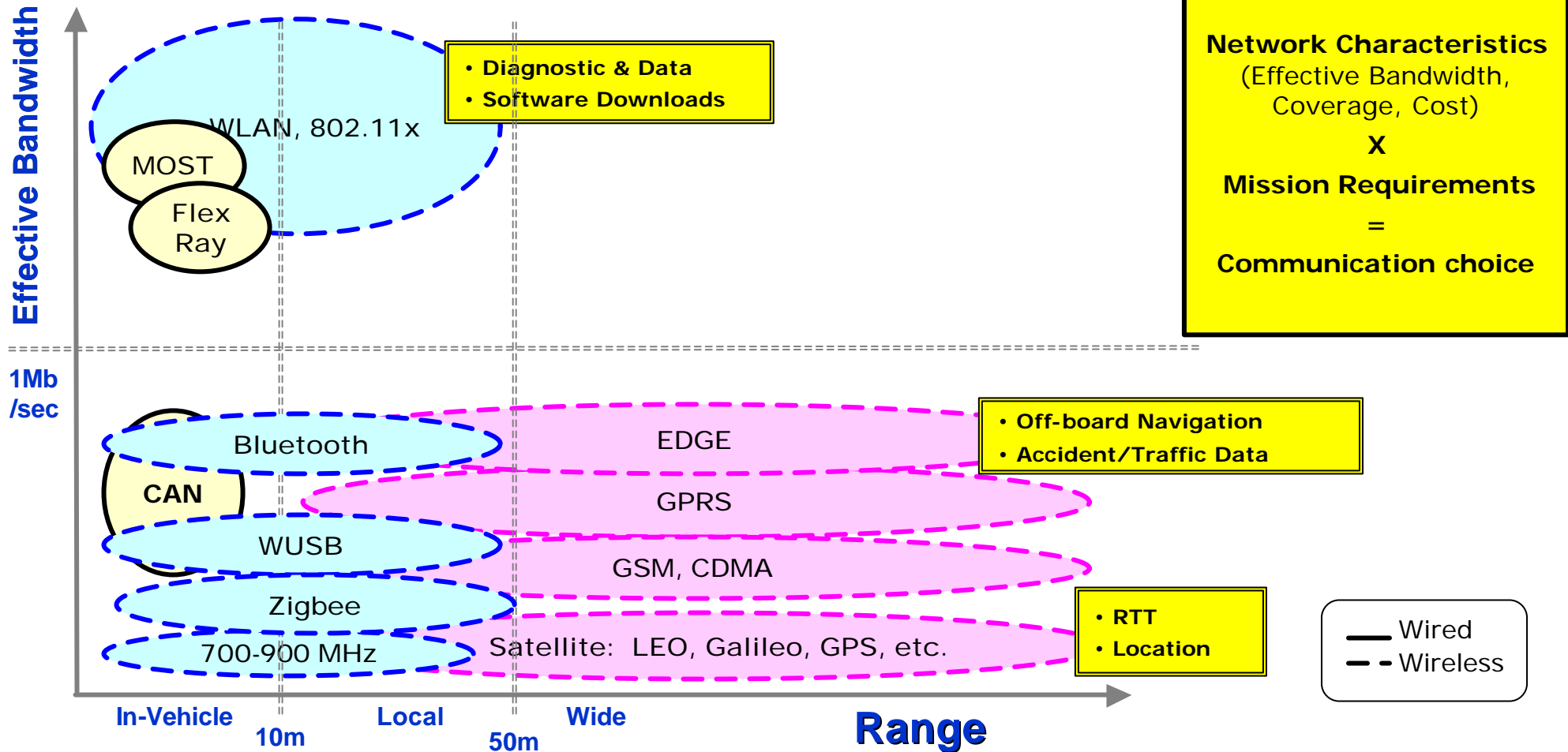


- Holistic approach
- Open Hardware Architecture with standardized internal interfaces
- Open Software Architecture with standardized APIs
- Customer value-add focused
- Forward looking
- Recognizing differences between vehicle-centric and consumer-centric functions

# Partition Features Along Vehicle-centric & Customer-centric Features



# Communication Technologies



**Network Characteristics**  
(Effective Bandwidth, Coverage, Cost)  
**X**  
**Mission Requirements**  
**=**  
**Communication choice**

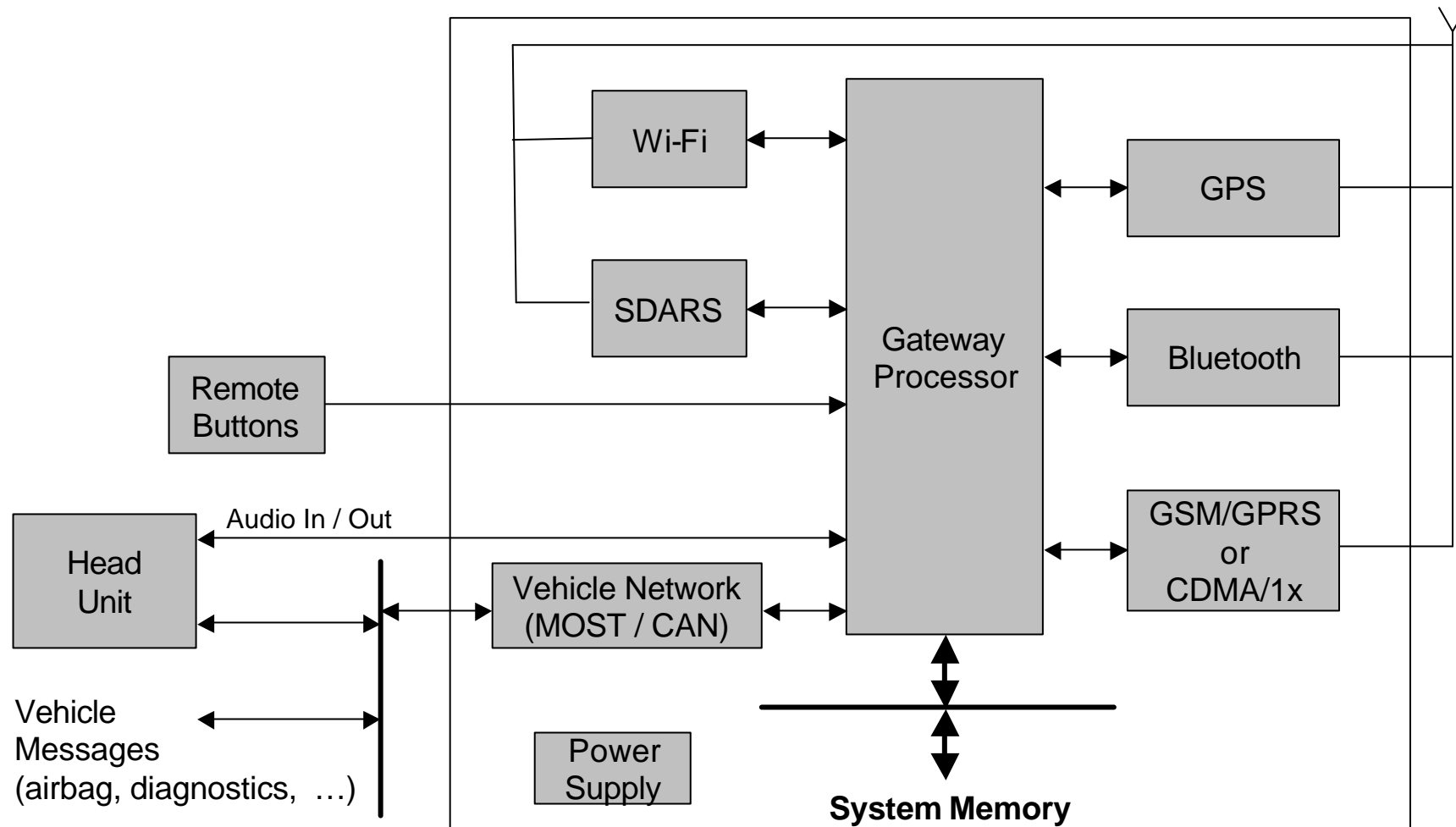


# Deploy Software Based Communication For Life Cycle Management Purpose



- **Current state:**
  - Chipset based embedded equipment supports single communication technology for life of product
- **Challenge:**
  - Many foreseen and unforeseen development directions (E.g. possibility of satellite-based GSM to provide coverage in rural areas, Wimax, 5.9 GHz WAVE)
- **Future state:**
  - Implement a fully updatable software-based communication module
  - Integrate into other vehicle electronics (e.g., navigation product, head unit) and connected to the in-vehicle network
  - Software controlled antenna controlled by software filters, providing the ability (within reason) to accommodate changes in frequency across the primary communications bands

# Implement an Architecture for Vehicle Communication Management



# Changing The Paradigm = Getting Focused On Consumer Value-add



- Automotive electronics complexity creep will not subside
  - Safety: functions for which consumers are ready to pay
  - Entertainment: Digital lifestyle ubiquity
- The historical proprietary architecture approach is a hurdle to handle the increasing electronics complexity
- We need to change paradigm & streamline the car communication architecture
  - Standardize mechanisms for flexibility
  - Partition
  - Leverage communication technologies
  - Think life cycle management
  - Implement gateway
- Once done, the industry will be able to focus on consumer value-add rather than the never ending integration challenges