Automotive Infotainment & Telematics
Supply Side Research and Consulting

- Devices
- Automotive
- Networks
- Media & Services
- Enterprise
- Components
- UX Innovation
ADDRESSING THE OPPORTUNITY

Where can we win?

- Infotainment & Telematics System & Semiconductor Demand Forecasts
- Regional Analysis and Forecasts
- Vehicle OEM Level Demand Analysis
- Incremental Business Opportunity Analysis

Will it be profitable?

- Application Growth Rate Analysis
- Average Selling Price Forecasts
- Impact of Industry Initiatives in Hardware & Software
- Impact of Legislation & Standardization on Future Demand
- Prospects of Disruptive Technologies or New Market Entrants

How big is the opportunity?

- Competitive Environment Analysis, Strengths & Weaknesses
- Market Shares of Tier 1 & Semiconductor Suppliers
- OEM - Supplier Relationships
- Application Technology Trends & Vehicle OEM Preferred Solutions
SA RESEARCH METHODOLOGY

LMC Automotive (formerly J.D. Power) production inputs by Region and vehicle segment
(75 fine Vehicle Segments)
WHAT CHANGES WITH 5G

- Lower latency communications
- Device to device connections
- Greater reliability
- Network slicing
- Layered, ubiquitous connectivity
- True IoT – network of everything
CORE 5G-ENABLED APPLICATIONS

- Autonomous driving
- Remote control
- Platooning
- Collision avoidance
- Inter-vehicle communications (V2V)
- Vehicle to infrastructure communications (V2I)
- Vehicle to pedestrian communications (V2P)
- Over-the-air updates
HARDWARE IN MARKET (CUMULATIVE)
OEM EMBEDDED TELEMATICS - GLOBAL

Units (000’s)

![Graph showing hardware in market](image)

- Hardware in Market

Source: Infotainment & Telematics Service
ACTIVE SUBSCRIPTIONS (CUMULATIVE)  
OEM EMBEDDED TELEMATICS - GLOBAL

<table>
<thead>
<tr>
<th>Year</th>
<th>Hardware in Market</th>
<th>Active Subs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td></td>
<td>10,000</td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>60,000</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>80,000</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>100,000</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td>120,000</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td>140,000</td>
</tr>
</tbody>
</table>
IN-ACTIVE SUBSCRIPTIONS (CUMULATIVE)
OEM EMBEDDED TELEMATICS - GLOBAL

Units (000's)


Hardware in Market
Active Subs
Inactive Subs

Source: Infotainment & Telematics Service
INACTIVE SUBS = DEAD $$$
OEM EMBEDDED TCU’S (UNITS/REVENUES)

Over $4 Billion wasted in 2017 alone
Over $12 Billion wasted 2011 → 2017
Telematics Forecast 2015 vs. 2023 (18.8 Mil. units → 78.6 Mil. units)

- **2.5G Network:** 7.4 Mil units in 2015 to 0K units from 2020
- **3G Network:** 8.4 Mil in 2015 units to 13.7 Mil units in 2023
- **4G/LTE Network:** 2.8 Million units in 2015 to 58 Mil units in 2023
- **5G Network:** 5.6 Million in 2023
Supporting rapidly evolving safety requirements and use cases

Continuous technology evolution to 5G while maintaining backward compatibility

**Basic safety**
802.11p or C-V2X R14
E.g. day 1 use cases
Forward collision warning and basic platooning

**Enhanced safety**
C-V2X R14
Extending electronic horizon, providing more reliability and NLOS performance
Non-line-of-sight
Icy road
0 mph
Blind curve hazard warning

**Advanced safety**
C-V2X R15+ (building upon R14)
For autonomous driving in real world conditions
High throughput communications for sensor sharing
Partially to highly automated driving
Cooperative driving
C-V2X EVOLUTION

May 2017
Strategy Analytics, Inc

SOURCE: Huawei
5GAA LEADS THE WAY

MEMBERS

- AT&T
- Audi
- BMW Group
- Bosch
- China Mobile
- Continental
- Danlaw
- DENSO
- Ericsson
- FeV
- Fujitsu
- Gemalto
- Hirschmann
- HUawei
- Infineon
- Intel
- InterDigital
- Jaguar
- LandRover
- Keysight Technologies
- LG
- NOKIA
- DOCOMO
- P3
- Panasonic
- Qualcomm
- Rohde & Schwarz
- SAIC Motor
- Sako Technologies Limited
- Samsung
- Savari
- SK Telecom
- SoftBank
- Telefonica
- T-Mobile
- Valeo
- Verizon
- VIAVI
- ZTE
Snapdragon 820A - A complete platform for compute

Snapdragon infotainment solutions: Helping to accelerate innovation through integration

SOURCE: Qualcomm
ARCHITECTURE IMPLICATIONS

• Single processor driving multiple functions
• Introduces embedded Android
• Support for Google Services, Maps, Nav, Search, Updates
• Marks turning point – beginning of the end of QNX in IVI – shift of QNX toward safety domain

• Android’s automotive shortcomings – boot time, power management, security – have been resolved or worked around
Beyond 2019, the outlook changes considerably

- **QNX**: Dominant and growing in all regions (Ford win as key driver)
- **Microsoft**: Declining in all regions (Ford loss as key driver)
- **Linux**: #2 OS choice globally by 2016
- **Android**: Very slow adoption
- **Other Embedded**: VXWorks, Greenhills (#3 in 2017)
ESSENTIAL TOOLS?

- Software updating
- Security
- Data management – security, privacy
- Orchestration of content, code, applications, suppliers, service providers
WHAT WE’RE SEEKING
MISSING PIECES

• Ubiquitous connectivity
• Inter-vehicle communication
• Data collection, aggregation, interpretation, sharing
• Monetization of data – data brokering
• Historical -> Real-time -> Predictive
• Artificial intelligence
• Machine learning
• Neural networks

• It’s more than just automotive...
WHAT’S CHANGED? DATA, 5G

- Smartphone on wheels
- “Data” is the new fuel driving the industry
- Driver access to vehicle data
- Driver control of vehicle data
- Transparency + control = trust
- Prioritizing privacy – Europe’s GDPR

“The more fleet learning of road conditions we are able to do, the better your Tesla’s self-driving ability will become.”
We are working hard to improve autonomous safety features and make self-driving a reality for you as soon as possible.

In order to do so, we need to collect short video clips using the car’s external cameras to learn how to recognize things like lane lines, street signs and traffic light positions. The more fleet learning of road conditions we are able to do, the better your Tesla’s self-driving ability will become.

We want to be super clear that these short video clips are not linked to your vehicle identification number. In order to protect your privacy, we have ensured that there is no way to search our system for clips that are associated with a specific car.
Allianz, Axel Springer, Daimler, Deutsche Bank with Postbank, Core, and Here to launch joint platform for online registration, e-identity and data services

Frankfurt am Main, May 8, 2017

Press Contact for this Press Release (1)

- “Master key” planned for online activities and public authorities
- Initiative seeks to provide competitive, European response to international platform economy
- German federal ministries welcome initiative

Leading German and European companies have stated their intention to cooperate more closely to establish a joint, pan-industry platform for online registration, e-identity and data services. The aim is to make online registration simpler and more secure for clients. The participating companies have signed a corresponding declaration of intent. The initiative was set up by Allianz, Axel Springer, Daimler and Deutsche Bank with Postbank as well as the technology think-tank Core, and Here Technologies, the location services provider.
WHAT’S AT STAKE?

• True IoT experience – Product Life-Cycle Management
• Access to data
  • E-commerce, banking
  • Insurance
  • Warranty cost avoidance
  • Smart city applications
  • Crowd sourcing – parking, lights
  • Law enforcement
  • Emergency services
• Perpetual product development
• Data brokering
• Always on connectivity
• Monetized connections
MWC = Mobile World Change : Reinvention

Services Δ
- Voice
- Text
- Data
- Digital Services

Networks Δ
- Softwarization
- Cloudification
- Intelligence
- Modular
- Distributed
- Open source
- Platform

Ecosystem Δ
- Global
- Verticals
- Telco
- OTTs
- Regulators
- Vendors as partners

Mindset Δ
- Flexibility / Agility / Collaboration / Innovation / DevOps

- we are in the middle of service reinvention
- 3rd party: open APIs
- Relevant: analytics + AI
- QoS/slicing
- Cloud
- Convergence fixed+mobile

October 2015
Strategy Analytics, Inc
Hybrid & Pre-5G Solutions in Commercial Trials with 5G E2E Platforms Emerging

- Gigabit LTE on show in components, smartphones & networks
- Non-standard pre-5G solutions on track for 2017 commercial services, strong fixed wireless support
- Family of 5G modems announced for large-scale trials and commercial deployment in 2019.
- 5G ready E2E platforms unveiled - Cloud RAN, C-RAN and vRAN “virtually everywhere”
- But strong support to accelerate 5G New Radio (NR) Standard
Path to 5G via Network Slicing

Network slicing demos showed potential benefits of 5G

- Deutsche Telekom live demo of 3 use cases with network slicing
- SK Telecom, DT, Ericsson partnered to show federated network slicing
STEPS ON THE PATH TO V2V

• Vehicle to call center to vehicle (1997)
• Smartphone to smartphone (2007)
• Vehicle to cloud to vehicle (2017) – (2017 Cadillac – DSRC V2V)
• C-V2X – 2020
• Increasingly seen as essential to automated driving
You can't see around corners. But your E-Class can.

World-first "Car-to-X" technology connects your E-Class to a central information resource, to send you in-car updates about driving conditions before you get to them. Your car can also report hazards, to help other E-Class drivers. [1]
Volvo’s vision of V2V

Sample Use Cases

- Connected Safety.
- Autonomous Driving.
- Amazingly Robust Navigation Systems.
BMW’s vision of V2N2V

VMS to dashboard

SPAT to dashboard

Map updating, editing

At intersections where there are dedicated traffic signals for turns, the activation of the vehicle’s turn indicator tells the app of the driver’s intention to turn so that only the status of the relevant signal is displayed.

ConnectedDrive permits a regular automatic navigation map update. The data are transferred "over the air" using the mobile SIM card installed and there are no licence charges or transmission costs for the user.
WILL EVERY CAR BUILD MAPS?

... and shares the data it collects
FROM CALL CENTERS TO AI

Call Center

Wi-Fi

A.I.

IoT

Strategy Analytics, Inc.
AUTONOMOUS IS A SOFTWARE PROBLEM

Many cars with hardware: Few cars SAE L4 or above

Source: Strategy Analytics Autonomous Vehicles Service
# Level 4 on the Road Today

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Areas of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2getthere</td>
<td>Autonomous Vehicle Infrastructure</td>
</tr>
<tr>
<td>Auro Robotics</td>
<td>Self-Driving Pods</td>
</tr>
<tr>
<td>Aurora Robotics</td>
<td>Civil and Military Robots</td>
</tr>
<tr>
<td>CityMobil</td>
<td>Autonomous Vehicle Hardware and Development Platform</td>
</tr>
<tr>
<td>EasyMile</td>
<td>Self-Driving Pods</td>
</tr>
<tr>
<td>GATEway (TRL)</td>
<td>Autonomous Vehicle Infrastructure</td>
</tr>
<tr>
<td>Induct Technology</td>
<td>Information Technology and Services</td>
</tr>
<tr>
<td>Local Motors</td>
<td>3D Printed Vehicles</td>
</tr>
<tr>
<td>NAVYA</td>
<td>Autonomous Vehicle Infrastructure</td>
</tr>
<tr>
<td>Vendor</td>
<td>Areas of Interest</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Next-Future-Mobility</td>
<td>Autonomous Vehicle Infrastructure</td>
</tr>
<tr>
<td>RDM Group</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>Robosoft</td>
<td>Software Solutions for Robotics</td>
</tr>
<tr>
<td>Robot Taxi</td>
<td>Fully Autonomous taxi</td>
</tr>
<tr>
<td>SB Drive Corp.</td>
<td>Autonomous Vehicle Hardware and Development Platform</td>
</tr>
<tr>
<td>Transport Systems</td>
<td></td>
</tr>
<tr>
<td>Catapult</td>
<td>Research &amp; Tech Institute</td>
</tr>
<tr>
<td>Varden Labs</td>
<td>Self-Driving Pods</td>
</tr>
<tr>
<td>WePod</td>
<td>Self-Driving Pods</td>
</tr>
<tr>
<td>Yandex</td>
<td>Computer Software</td>
</tr>
<tr>
<td>Zoox</td>
<td>Self-Driving Pods</td>
</tr>
</tbody>
</table>
V2V/V2X

• Market development HIGHLY dependent upon mandates – C-V2X offers an organic path to market adoption

• 802.11-based approaches seen as having huge business model challenges by Strategy Analytics. Who will pay for new, automotive-specific infrastructure?

• LTE/5G approaches including C-V2X can overcome these issues
  • Latency-critical applications should rely on on-board sensors
  • Yes, network coverage is not universal – but it is a lot wider than a dedicated automotive network could hope to be in any reasonable timeframe
  • 5G peer-to-peer capabilities will allow V2V even without network coverage

• Smartphones and apps
  • Speed to market; Consumer familiarity
  • Ubiquitous usage/device ownership
  • Global Mobile Alert, Haas Alert, Ridar Systems
V2I: THE MISSING PIECE

• To escape geo-fencing – automated driving will need vehicle to infrastructure communications

• Cellular is best positioned to enable V2I at low cost and within a short time horizon

• Cellular infrastructure can be reused as RSU, particularly for C-V2X
The Goal!
IF WE FAIL...
CONCLUSIONS

• Ubiquitous connectivity is transforming how vehicles are used and owned
• Monetization of data will pay for connectivity
• Autonomous vehicles are already here – Cellular V2I is the essential application to open up autonomy in urban areas
• Privacy, security concerns must be overcome to enable this new connectivity environment
• Data sharing and inter-vehicle communications are in the process of being resolved today
• 5G collaboration between automotive and wireless industries is a game changer for solving these challenges
ANY QUESTIONS?