Automotive Electronics and Software 2030 – Market and Trend outlook
Current challenges in automotive electronics and software and objectives of the collaboration project

**Background: GSA-McKinsey cooperation**

- **Intensive research collaboration** focusing on the most relevant topics for the semiconductor industry, e.g.,
- The Internet of Things – opportunities and challenges for semiconductor companies (2015)
- **Security** in the Internet of Things (2016)
- **Project steering** by GSA EMEA Executive Forum, with knowledge input through interviews and surveys by many industry players / GSA members
- **Publications** and wide industry dissemination

**Current hot topic: Automotive Electronics and Software 2030 – Market and Trend outlook**

**Challenges in automotive SW and electronics**

- The automotive industry sees itself challenged through massive technological disruptions – namely autonomous driving, connected cars, electrification, and shared/diverse mobility
- All of these trends have a profound impact on the future software and electronics architecture in vehicles and beyond, e.g.
  - Consolidation of distributed computing in ECU’s into more central domain controllers
  - Abstraction of software functionality from hardware
  - Significant increase in computing power and requirements in modern cars
  - **New** types and quality of sensors
  - Software-centric development of customer functions and experience
  - …
- These new requirements have the potential to disrupt the value chain around automotive electronics and software with a severe impact on current and potentially new players – with both potential upsides and risks through new market dynamics

**Objectives of the collaboration project**

- In a joint collaboration project, McKinsey and the GSA will develop:
  - a quantitative granular market model of the automotive electronics and software market
  - investigate trends (autonomy, connectivity, electrification, and shared mobility) and related opportunities
  - map out the industry landscape, by identifying how players in the market position themselves along the value chain
- The target audience of the results includes all players in the automotive industry, e.g., OEMs, tier-1 suppliers, semiconductor suppliers, as well as companies beyond that are interested to enter the automotive software or electronics market
- The results of the project will be summarized in an article available to GSA members as well as in supporting formats like keynote speeches on conferences and dedicated panel/workshop discussions (including intermediate reviews)

Objective today: Discuss overarching and semicon-specific trends in the automotive electronics and software market
Results of the project will be translated into concrete publications and presentations available to GSA members

End products of the collaboration

Automotive software and electronics market model
- Granular market model for software and electronics market in automotive allowing a drill-down into functional domains, geographies, and technologies over time taking into account several adoption scenarios

Assessment of trends and implications
- Qualitative assessment of recent trends in automotive electronics and software with an outlook on expected technological and business innovation with an impact on the market

Analysis of moves along the value chain
- Assessment of disruptions of the value chain, i.e. outlook on the value chain of future electronics/software generations and analysis of potential players and recent moves (partnerships, M&A) for these new technologies

Formats for publication and dissemination

GSA expert workshops
- Involvement of GSA members in detailed expert workshops – both during and after the project

Keynote on conference(s)
- Summary of results in a keynote speech at a GSA conference (and potentially a dedicated event for this topic)

Published article
- Publication of an article/a brochure summarizing qualitative and quantitative findings of the collaboration
The E/E architecture has evolved from independent function – specific ECUs towards a centralized architecture.

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<thead>
<tr>
<th>Generation</th>
<th>High-level architecture</th>
<th>Main features</th>
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<tbody>
<tr>
<td>Vehicle</td>
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<tr>
<td>centralized</td>
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<td>E/E architecture</td>
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<td>E/E architecture</td>
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<td>Distributed</td>
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<td>E/E architecture</td>
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### 1st generation
- Independent ECUs
- Isolated functions
- Each function has its ECU (1:1 connection)

### 2nd generation
- Collaboration of ECUs within one domain
- Domains: body/comfort, chassis, powertrain, and infotainment
- 3-4 independent networks
- Limited communication between domains

### 3rd generation
- Stronger collaboration via central gateway
- Cross-functional connection
- Ability to handle complex functions, e.g. ACC

### 4th generation
- Central domain controller
- Ability to handle more complex functions, e.g. L3 HAD
- Consolidation of functions (cost optimization)

### 5th generation
- Virtual domain
- Limited dedicated hardware
- Ethernet backbone
- High complex, high compute functions
- Suitable for L4-L5 HAD

**Future outlook**

New E/E architecture generations will open opportunities for established and new players along the value chain with significant upside but also risks if changes are not correctly anticipated and taken into account.
Software becomes increasingly important with SW and electronics comprising more than 50% of vehicle content by 2030 – a more granular model should help navigating this space.

**Average content per vehicle**, USD

<table>
<thead>
<tr>
<th>Year</th>
<th>Software</th>
<th>Electronics &amp; electrical</th>
<th>Mechanical</th>
<th>Mechanical &amp; electrical integration</th>
</tr>
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<tbody>
<tr>
<td>2010</td>
<td>7%</td>
<td>21%</td>
<td>68%</td>
<td></td>
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<tr>
<td>2016</td>
<td>10%</td>
<td>23%</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>30%</td>
<td>30%</td>
<td>41%</td>
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</table>

**Implications for the project**

- Both electronics and especially SW content is accelerating rapidly as industry transitions from “HW-defined” to “SW-defined” vehicles.
- To align strategies with this market growth, a more granular view on the market is required, e.g.
  - Which domains and components are driving the growth?
  - Which delivery models and services are applicable for vehicle software?
  - How does the value chain for new systems change?
  - What is the split between R&D costs and material costs?
  - …
- Growth in Electronics and SW will be significantly driven by AV & EV adoption.

**CAGR, 2016-2030**

- Additional 2-4% expected over vehicle lifecycle.
We will use a combination of formats to build-up the content and market model involving GSA member experts iteratively over the course of the project.

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<tr>
<td>▪ Definition of market drivers and core assumptions</td>
<td>▪ Cost break-down discussion of main components</td>
<td>▪ Discussion of intermediate results in several workshops with GSA experts and experts from other companies (e.g. OEMs, tier-1s) to test hypotheses and findings</td>
<td>▪ Summary of findings in an article describing market dynamics and providing a quantitative outlook</td>
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<tr>
<td>▪ Definition of market scenarios for EV/AV adoption and other technology adoptions with impact on electronics</td>
<td>▪ Discussion of technology requirements (e.g. for different levels of autonomous driving)</td>
<td>▪ Iterative refinement of the market model and trend/implications analysis</td>
<td>▪ Translation of results into keynote presentation and other publication formats within GSA events and beyond</td>
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<td>▪ Clustering of domains and components (software and electronics)</td>
<td>▪ Challenging of adoption curves</td>
<td>▪ Finalization of market model analysis including different market growth scenarios</td>
<td>▪ Feedback to highly involved experts on overall results (e.g. including follow-up meetings to guide through outcomes)</td>
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<td>▪ Creation of base model</td>
<td>▪ Workshops conducted with single GSA members to allow sharing of confidential information in “clean team” approach</td>
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**Trends and implications**

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<th>Interviews with GSA members (Oct 2018 – Feb 2019)</th>
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<td>▪ Interviews with GSA members (and potentially further companies) to test hypotheses on market dynamics in software and electronics</td>
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<td>▪ Questions targeted on likelihood of technology adoption, changes in the value chain, relevance of segments/domains, etc.</td>
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<th>Analysis of market developments (Oct 2018 – Feb 2019)</th>
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<td>▪ Assessment of recent and future market developments along the software and electronics value chain, e.g. analysis of recent M&amp;A or partnering activities, screening of technology announcements, etc.</td>
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<td>▪ Review of existing publications describing changes and providing outlooks on automotive electronics and software</td>
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**Optional/tbc:** Survey based assessment of GSA members (Jan 2019 – Feb 2019)

**GSA conference in April 2019**
For discussion: Questions around the automotive electronics and software industry

**Overarching**

- How does the **electronic component** and **software market develop** given **disruptions** through **ACES** (Autonomous, Connected, Electric, and Shared) trends and **new E/E and software architectures** in vehicles? Which **components** could be a **focus area** for **business development**?
- What do you think is the **level of readiness** for different **types of actors** in the **automotive electronics value chain** to discuss/align on **new electronics architectures**?
- What do you think is the **timeline** that different **OEMs/tier 1s** switch to **new architectures** and change their sourcing correspondingly?
- Which **capabilities** are **required** to **compete** in the **future around electronics and software**?
- For which **components** in **automotive electronics** do you think **software** (in terms of e.g., **development kits** or **algorithms**, i.e., beyond firmware or drivers) will be a **key element of the product**?

**Semicon-specific**

- How does the **semicon market** in **automotive develop**? Which are **technologies/components** in which **semicon** will **gain importance**?
- How can **semicon companies position** themselves **along** the **value chain** to **avoid commodization** (e.g. higher integration, software capabilities, etc.)?
- In which **part/segment** of the **semicon market** do you see **growth potentials in terms of** moving from a **component supplier to a systems supplier or systems partner**?