MONETIZING THE CONNECTED CAR

Dr. Walter J. Buga
CEO
September 19, 2013

VIRTUAL SUMMIT: CONNECTED CAR USA 2013

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Agenda:

- The Connected Car Ecosystem
- Revenue Opportunities & Potential
- Connected Vehicle Playing Field
- Ecosystem in Action: Major Headlines
- Conclusions:
  - The Next steps for Monetizing the Connected Car
  - Future Business models
Connected Car Domains

- **the vehicle**, consisting of the in-vehicle network and ECUs:
  - both software and firmware
- **the portal** and/or back office at the automotive company, enterprise, or customer:
  - delivering services to the vehicle, and to the customer
- **the connectivity** between the vehicle and the services, that could be owned by:
  - OEM, Enterprise, Customer, or others

<table>
<thead>
<tr>
<th>Connectivity Type</th>
<th>Embedded</th>
<th>Tethered (IP sharing)</th>
<th>Smartphone Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modem</td>
<td>Built-in</td>
<td>Brought-in</td>
<td>Brought-in</td>
</tr>
<tr>
<td>UICC (&quot;SIM&quot;)</td>
<td>Built-in</td>
<td>Brought-in</td>
<td>Brought-in</td>
</tr>
<tr>
<td>Intelligence/Applications</td>
<td>Built-in</td>
<td>Embedded</td>
<td>Brought-in</td>
</tr>
<tr>
<td>User Interface</td>
<td>Vehicle HMI</td>
<td>Vehicle HMI</td>
<td>In vehicle HMI OR Phone HMI</td>
</tr>
</tbody>
</table>

*Source: GSMA, Connected Cars: Business Model Innovation*
Car Networking Options

- **Car-to-car:**
  1. increased safety as vehicles can communicate with each other and pass warning on dangerous situations such as wet roads

- **Car-to-OEM and/or services:**
  1. technical problems could be diagnosed and even repaired remotely (e.g. for software/firmware updates)
  2. Valuable data for OEMs, app developers, Mobile Service Providers

- **Car-to-enterprise:**
  1. offering new business opportunities to virtually all existing and future automotive players, from gas stations, car park operators, to music streaming, navigation, insurance providers and new web services

- **Car-to-x-connectivity:**
  1. communication with any Internet capable device

- **Car-to-infrastructure:**
  1. traffic jams, red lights, paying tolls, etc.
Value of Connection?

- Can Metcalfe’s law apply to connected cars?
  - Metcalfe's law states that the value of a network is proportional to the square of the number of connected users within the system (n^2).
  - Could car-to-car networking be a case?
  - Can we treat the connected car as a packet that is carrying you as payload, from your origination to destination address, and to optimize its/your route based on specific QOS requirements?

- Cost for the payer is a revenue for the payee
  - New business and subscription models are needed

- Value of location (because it is mobile)
  - Would you like to know if your friend is near by?

- Value of your time in a car
  - It is estimated that people spend an average of 52 minutes each working day commuting
Where are the Revenue opportunities?

- They are in the life cycle management of cars and customers that includes:
  - Pre sales (production) and post sales (after market) cycles

- Today’s OEM model is product based:
  - Sell once, and forget about your customer

- It must change to a subscription model:
  - Monetize and keep existing customers
  - Bring new customers
  - Offer new services continually
  - Subsidize the price of the car by services
  - Manage customer churn
Who are the Payees (who can make money)?

- Vehicle manufacturing, distribution, & supply chain
- Vehicle sales, dealerships, & financing
- Vehicle servicing, repair, & warranty
- Vehicle insurance & roadside assistance
- Vehicle rental services (ie. Car2go, Zipcar)
- Communications and connectivity providers
- Infotainment and navigation services
- Concierge and convenience services
- Advertisers
- Apps developers
- Data mining and analytics

These payees will need to change their current business models to take advantage of connected car opportunity
Revenue Potential

Machine-to-machine connections and revenue in the automotive sector, 2011-22
[Source: Machina Research, 2013]

• The above overall revenue opportunity is only a small part of the equation for automotive OEMs.
• The Connected Car will fulfill a number of other important purposes:
  • Create a better user experience
  • Build an ongoing relationship with customers
  • Develop new models of mobility
  • Allow for data gathering on vehicle usage
  • Meet regulatory demands

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Revenue Opportunity:

In revenue terms, SBD estimates the overall market will be three times larger in 2018 than it was in 2012, comprising:

- €24.5 billion from in-vehicle services, such as traffic information, call centre support and web-based entertainment (up from €9.3 billion in 2012);
- €6.9 billion from the sale of hardware, such as telematics control units (up from €1.2 billion in 2012);
- €4.5 billion from the delivery of telematics services, such as customer relationship management, (up from €1.8 billion in 2012);
- €4.1 billion from the provision of connectivity, such as mobile data traffic (up from €814 million in 2012).

Source: GSMA Connected Living programme: mAutomotive
Connected Vehicle Playing Field

Source: Roland Berger

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Two major players: OEMs & MNOs

- The success of the Connected Car requires mobile network operators (MNOs), and automotive OEMs to work in harmony.
- However, the two have radically different heritages and different approaches.

<table>
<thead>
<tr>
<th>Cellular</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 years old</td>
<td>111 years old</td>
</tr>
<tr>
<td>Local/regional</td>
<td>Global</td>
</tr>
<tr>
<td>Rapid turnover and development</td>
<td>Long development cycles</td>
</tr>
<tr>
<td>Extended relationship with customer</td>
<td>Transactional relationship</td>
</tr>
<tr>
<td>Open to application developers</td>
<td>Wary of third parties</td>
</tr>
<tr>
<td>Best efforts</td>
<td>Strict safety &amp; reliability obligations</td>
</tr>
</tbody>
</table>

Source: Machina Research, 2013
Ecosystem In Action: Selected Headlines

- Volvo, Ericsson jointly connect cars to the cloud
- Verizon Partners with OEMs to Launch 4G Forum for Connected Cars
- AT&T, GM team up to make 4G cars
- BMW selects Vodafone for Connected Car services
- Sprint, Chrysler Link Up With ‘Velocity’ In-Car System
- IBM And Sprint Team Up On Smarter Connected Cars
- AT&T, SiriusXM and Nissan collaborate on connected car initiative
- Volkswagen partners with Apple on iBeetle, first car with fully integrated iPhone
- Audi and T-Mobile partner to launch the industry’s most competitively priced in-vehicle data plan
- Continental is teaming with Cisco to work on developing technology for connected vehicles.
- Continental Teams Up With IBM to Cooperate on Automated Driving
- Mercedes, Nokia team up on smart maps for connected cars
Monetizing the Connected Car:

- Mobile Service Providers and OEMs must work together to develop new revenue generating business models
- OEMs options: Consumer prepaid or subscription model for in-vehicle applications and other value added services
- OEMs to provide tiered Telematics/Connected options to upsell and differentiate between car models and competing with other OEMs:
  - Standard, Upgraded, Luxury Edition
  - No charge for updates
- Subsidize hardware costs through services sold/provided:
  - Low to free subscription to maintain/grow customer base/loyalty
  - Revenue from advertising and data (for analytics and apps)
- Create and grow ecosystems of payees/potential money-makers
- Adapt to consumer needs, as rate of adoption or conversion will depend on consumer perception of value added services.
Thank You

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Arynga at a glance

• Headquarters: San Diego, CA
• Qualcomm Labs/EvoNexus company
  ◦ Selected from 100 applicants
  ◦ Full due diligence performed
• Engineering offices: San Diego and Poland
• 2012/13 Industry Newcomer Award: Honorable Mention, by Telematics Update
• Arynga was mentioned in the July, 2013 Forrester Research, Inc. report: “The Connected Car, Prepare for the Next Computing Environment”.
• Initial product: CarSync™
  ◦ Demos at
    • Genivi Alliance meeting, Shanghai, October 2012
    • CES, Las Vegas, January 2013
    • Genivi Alliance meeting, Barcelona, April 2013
    • Telematics Detroit, June 2013
• Proof of Concept (PoC) customer contract: Q1 2013
• Version1.0 CarSync Product: Q3 2013
• Upcoming Showcases:
  ◦ Genivi Alliance meeting, San Diego, October 2013
  ◦ CES, Las Vegas, January 2014

Management:
• Dr. Walter J. Buga – Chairman & CEO
• John Cain – Sales/BD – Automotive
• Ron Wangerin – Finance/Strategy
• Magda Remillard - Operations and M2M
• Engineering Team in Poland – R&D and Product Development
Connected Transportation Issue:
Ever increasing number of vehicles (autos, buses, trains, etc.) utilizing/controlled by software. Need for a framework-based approach, built on a structured, future proof, and Internet friendly architecture, to enable effective and efficient updates to these vehicles.

- **OTA Configuration Management of Vehicle Firmware, Software and Applications**: Arynga’s CarSync™ Cloud Server
- **Configuration Management and Update of ECUs within Vehicle**: Arynga’s CarSync In-Vehicle Server/Gateway
  - Through CAN, LIN, MOST, FlexRay, and Ethernet
- **Connectivity for Vehicle-to-Vehicle and Vehicle-to-Infrastructure**: Arynga’s Next Generation Product
CarSync™ Platform Architecture

**Safety & Security Services**
- Collision Notification
- Emergency Call
- Roadside Assistance
- Vehicle Location
- Alarm Notification
- eCall
- DSRC

**Navigation & Media Services**
- Internet Apps (Yelp, FB, Google, etc.)
- Music & Info Services
- Points of Interest
- Route Assistance
- Parking Assistance
- Location-Based Traffic
- Location-Based Weather

**Driver Assistance Services**
- Remote Door Lock/Unlock
- Dealer/OEM Connect
- Tolls & Payments
- Car information
  - Fuel
  - Oil pressure
  - Tire pressure

**Diagnostics & Update Services**
- Remote OBD
- FOTA
- Apps Download
- Software updates

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**CarSync™ Cloud Server (Backend Infrastructure & Connectivity)**

- Internet

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**CarSync™ Gateway (In-Vehicle ECU or External Module)**

- Power Train
- Chassis
- Body & Comfort
- Safety & Security
- Infotainment & Telematics

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**Remote Operation Center**

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CarSync™ Product Suite

Management System
- Message broker
- Database manager
- File system
- Backend application
- API for third party data management
- OTA Service bus

Release Package Tool
- Creator
- DIFF Engine
- Security access
- Encryption

Gateway
- Administrator
- Informer DBMS
- Update manager / controller
- Bus manager
- Drive monitor

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## Recent Recall Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>OEM</th>
<th>Vehicle</th>
<th>Issue</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Jeep</td>
<td>Cherokee</td>
<td>Electrical spikes in central body software</td>
<td>4,500</td>
</tr>
<tr>
<td>2013</td>
<td>Chrysler</td>
<td>Minivans</td>
<td>Airbag SW</td>
<td>N/A</td>
</tr>
<tr>
<td>2013</td>
<td>Dodge</td>
<td>RAM 1500</td>
<td>Stability control SW</td>
<td>46,000</td>
</tr>
<tr>
<td>2013</td>
<td>Ford</td>
<td>LEVs</td>
<td>SW update to improve fuel efficiency</td>
<td>50,000</td>
</tr>
<tr>
<td>2013</td>
<td>Ford</td>
<td>Escape</td>
<td>Cooling system software</td>
<td>All</td>
</tr>
<tr>
<td>2012</td>
<td>Buick</td>
<td>LaCrosse</td>
<td>Brake SW</td>
<td>1,300</td>
</tr>
<tr>
<td>2012</td>
<td>Volvo</td>
<td>S60</td>
<td>Fuel pump SW</td>
<td>7,600</td>
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<tr>
<td>2012</td>
<td>Honda</td>
<td>Fit</td>
<td>Stability assist system SW</td>
<td>44,000</td>
</tr>
<tr>
<td>2011 - 2013</td>
<td>Chrysler</td>
<td>Various</td>
<td>Head restraint system software</td>
<td>500,000</td>
</tr>
<tr>
<td>2011</td>
<td>Cadillac</td>
<td>SRX</td>
<td>Airbag SW glitch</td>
<td>50,500</td>
</tr>
<tr>
<td>2011</td>
<td>Buick</td>
<td>LaCrosse</td>
<td>Electronic climate control SW</td>
<td>10,000</td>
</tr>
<tr>
<td>2011</td>
<td>Nissan</td>
<td>Leaf</td>
<td>Faulty SW</td>
<td>5,500</td>
</tr>
<tr>
<td>2011</td>
<td>Ford</td>
<td>Pickups</td>
<td>Integrated diagnostic system glitch</td>
<td>8,000</td>
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<tr>
<td>2010</td>
<td>Toyota</td>
<td>Prius</td>
<td>Brake control system SW</td>
<td>500,000</td>
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<tr>
<td>2006 - 2010</td>
<td>Toyota</td>
<td>Various</td>
<td>Acceleration issues</td>
<td>5,600,000</td>
</tr>
<tr>
<td>2005 - 2010</td>
<td>Honda</td>
<td>Accord, CRV, Element</td>
<td>Automatic transmission SW</td>
<td>2,500,000</td>
</tr>
<tr>
<td>2009</td>
<td>Cadillacs</td>
<td>CTS</td>
<td>Passenger sensing system SW</td>
<td>12,660</td>
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<tr>
<td>2008</td>
<td>VW</td>
<td>Passat</td>
<td>Engine control SW</td>
<td>6,500</td>
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<tr>
<td>2006</td>
<td>Jeep</td>
<td>Commander</td>
<td>Automatic transmission SW</td>
<td>24,500</td>
</tr>
<tr>
<td>2005</td>
<td>Toyota</td>
<td>Prius</td>
<td>SW problem causes car to stall or shut down</td>
<td>160,000</td>
</tr>
</tbody>
</table>
Management Bios

**Walter Buga, CEO**

Walter is a serial entrepreneur and strategic thinker with extensive knowledge of high-tech markets, products, and technologies. He is a telecommunications subject matter expert in both wired and wireless networks and technologies, who has designed large-scale systems that have been deployed throughout the world. Walter is an active participant and contributor to multiple standards organizations and forums including IEEE, IETF, ITU, ANSI, Broadband Forum, and TM Forum. Dr. Buga held senior management and leadership positions at Bell Laboratories of AT&T and Lucent Technologies. He is also an inventor (multiple granted patents and more pending, in wireless technology), and an author of numerous papers, and frequent speaker at major industry events and conferences. Dr. Buga holds BS, MSEE, and PhD degrees in the Technical Sciences from the Technical University of Wroclaw, Poland.

**Ron Wangerin, Finance**

Ron is a senior financial executive with 25 years of diverse financial experience, including 10 years as CFO of a publicly traded telecom and defense company; 2 years as CFO with a wireless start-up company, 3 years as CFO with a subsidiary of Raytheon Company and 9 years with Deloitte & Touche LLP in public accounting. In his capacity as CFO, he has directed all financial and business management activities, including accounting, financial planning, budgeting, tax strategies, internal controls and compliance, treasury / financing, risk management / insurance, financial systems and building strong teams to support Corporate and business requirements. He has extensive experience raising capital (debt and equity), managing and communicating with Boards of Directors, investors, analysts, external advisors (bankers, attorneys, auditors) and regulators. Further, Ron has significant expertise in evaluating, negotiating and integrating acquisition candidates. Mr. Wangerin received his Bachelors of Science in Accounting and Masters of Accounting from the University of Southern California.

**Magda Remillard, Operations**

Magda is a veteran mobile industry entrepreneur having founded Zaxis Technology, a pioneer in mobile applications porting technology. Prior to joining Arynga, she headed business development at FieldLogix, an M2M start-up in the area of fleet and industrial assets tracking. Previously Magda was involved in business development efforts at Novatel Wireless and at Commnexus, the Mobile Industry Organization in San Diego. Before she founded Zaxis, she was involved with several San Diego start ups including PRAJA, Golfsat, and PersonaLogic, Inc, which was her first Internet related experience. Magda also held several IT management positions within the Savings and Loan and Mortgage Banking industry. She received her Bachelors from the University of California, San Diego.

**John Cain, Business Development**

John started his career as mechanical applications engineer (Industrial and aerospace power transmission systems) for Western Gear (now part of Northrop Grumman) and worked in business development and product marketing roles for United Technologies and Lucas Electronics (now TRW). Additionally, he was the Director of Automotive at Philips Semiconductors (now NXP) and VP of Automotive at Siemens Microelectronics (now Infineon). In 2002, John formed 3IS, a Michigan based company providing electronics research tools, services and consulting to the automotive industry. He has authored one patent on IT related server query and published several industry white papers & studies primarily focused on automotive software and software development, including: Automotive NetComm Software and Development Tools, CMMI and Software Maturity Models, PLM for Automotive Software Development, Marketing Requirements Document for Open Source IVI Software Report: 2010. He received a Bachelor’s degree from VA Tech & MBA from Loyola.

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