MONETIZING THE CONNECTED CAR

Citi 2013 Connected Car Symposium

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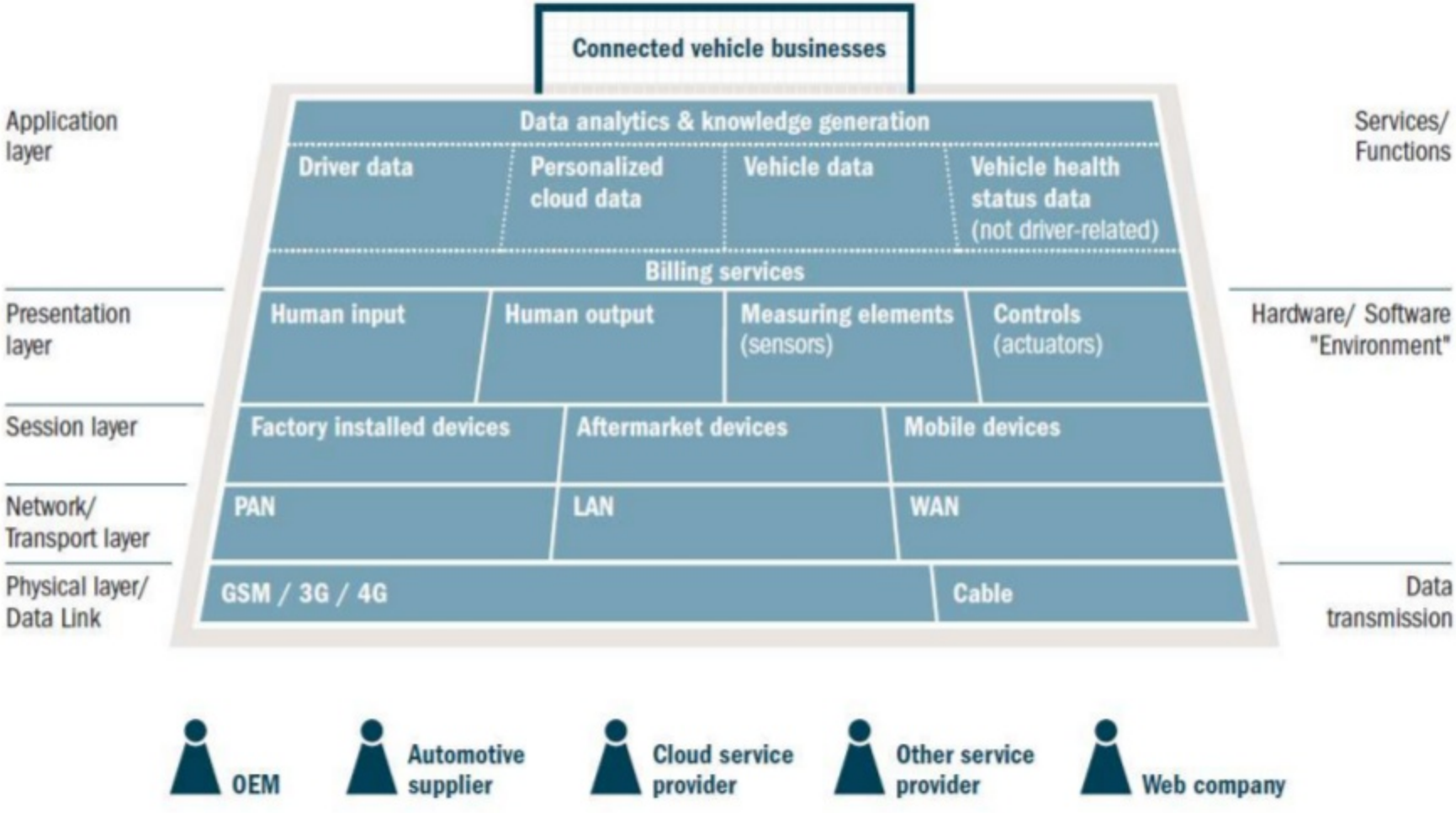
Agenda:

- Connected Vehicle Playing Field
- Ecosystem in Action: Major Headlines
- The Connected Car Domains
- Value of Connected Car
- Revenue Opportunities and Flows
- Life Cycle Challenges
- What Are Ecosystem Players Doing Now
- The Future

Connected Car Applications

Source: Novero

Connected Vehicle Playing Field



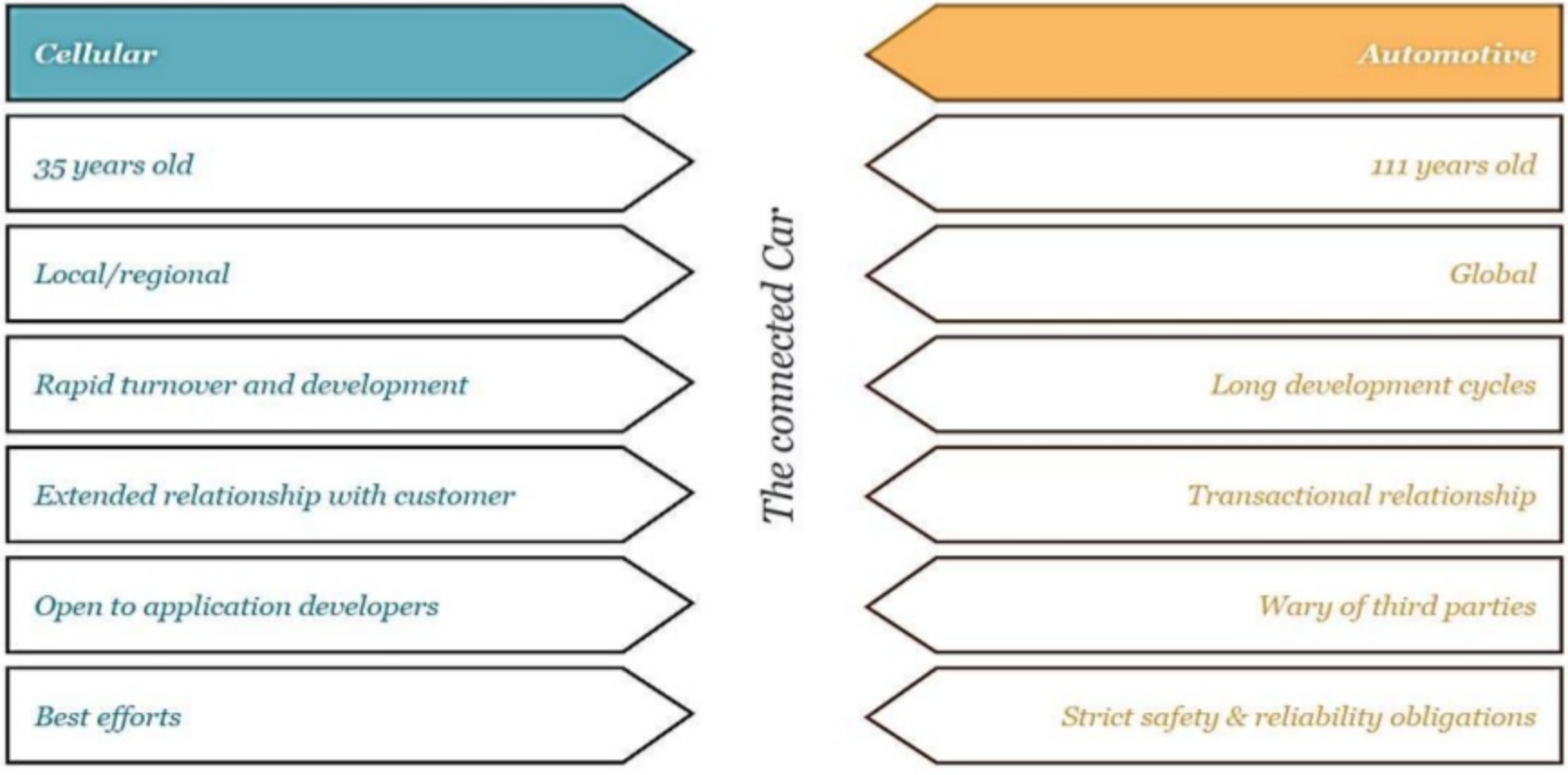
Source: Roland Berger

Car Networking Options

- **Car-to-car**
  - Increased safety as vehicles can communicate with each other and inform on dangerous situations such as wet roads, ice, accidents, etc.
- **Car-to-OEM and/or services**
  - Technical problems could be diagnosed and even repaired remotely (e.g. for software/firmware updates)
  - Valuable data for OEMs, app developers, Mobile Service Providers
- **Car-to-enterprise**
  - New business opportunities to 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**
  - Communication with any Internet capable device
- **Car-to-infrastructure**
  - Traffic, red lights, paying tolls, etc.

Two major players: OEMs & MNOs

- The success of the Connected Car requires **mobile network operators** (MNOs), and **automotive OEMs** to work in harmony
- Rollout of 4G networks provides backbone necessary for implementation
- OEMs and MNOs have radically different heritages and different approaches



Source: Machina Research, 2013]

Connected Car Domains

- **The vehicle**, consisting of the in-vehicle network and ECUs:
  - Both software and firmware
- **The cloud** and/or back office at the OEM, enterprise or customer:
  - Delivering services to the vehicle, and to the customer
  - Big data, storage, analytics
- **The connectivity** between the vehicle and the services, that could be owned by:
  - OEM, Enterprise, Customer, or others

Connectivity Type	Embedded	Tethered (IP sharing)	Smartphone integration
Modem	Built-in	Brought-in	Brought-in
UICC ("SIM")	Built-in	Brought-in	Brought-in
Intelligence/ Applications	Built-in	Embedded	Brought-in
User Interface	Vehicle HMI	Vehicle HMI	In vehicle HMI OR Phone HMI

Source GSMA: Connected Cars: Business Model Innovation

Connected Car Issues & Risks

- **OEM supply chain**
  - Vehicles are assembled, not an integrated design (ex Tesla)
  - Numerous layers, software platforms, operating systems
- **OEM & Dealer network business model incongruent with technology, internet, data-driven business model**
- **Software / technology cycles (weeks or months) versus OEM development cycles (years)**
- **Regulatory**
  - Distracted driver
  - Safety and security
  - Differing international standards
- **Who owns the data?**
- **What is the value?**
- **How is the data protected?**

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 (n2)
  - 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 route based on specific QOS requirements?
- **Cost for the payer is revenue for the provider**
  - New business and subscription models are needed
- **Value of car data**
  - Driver and passenger behaviors and activities
  - Car sensory data
- **Value of location (because it is mobile)**
  - Would you like to know if your friend is near by? Cheapest gas?
- **Value of your time in a car**
  - It is estimated that people spend an average of 52 minutes each working day commuting

Data Ownership = Complex

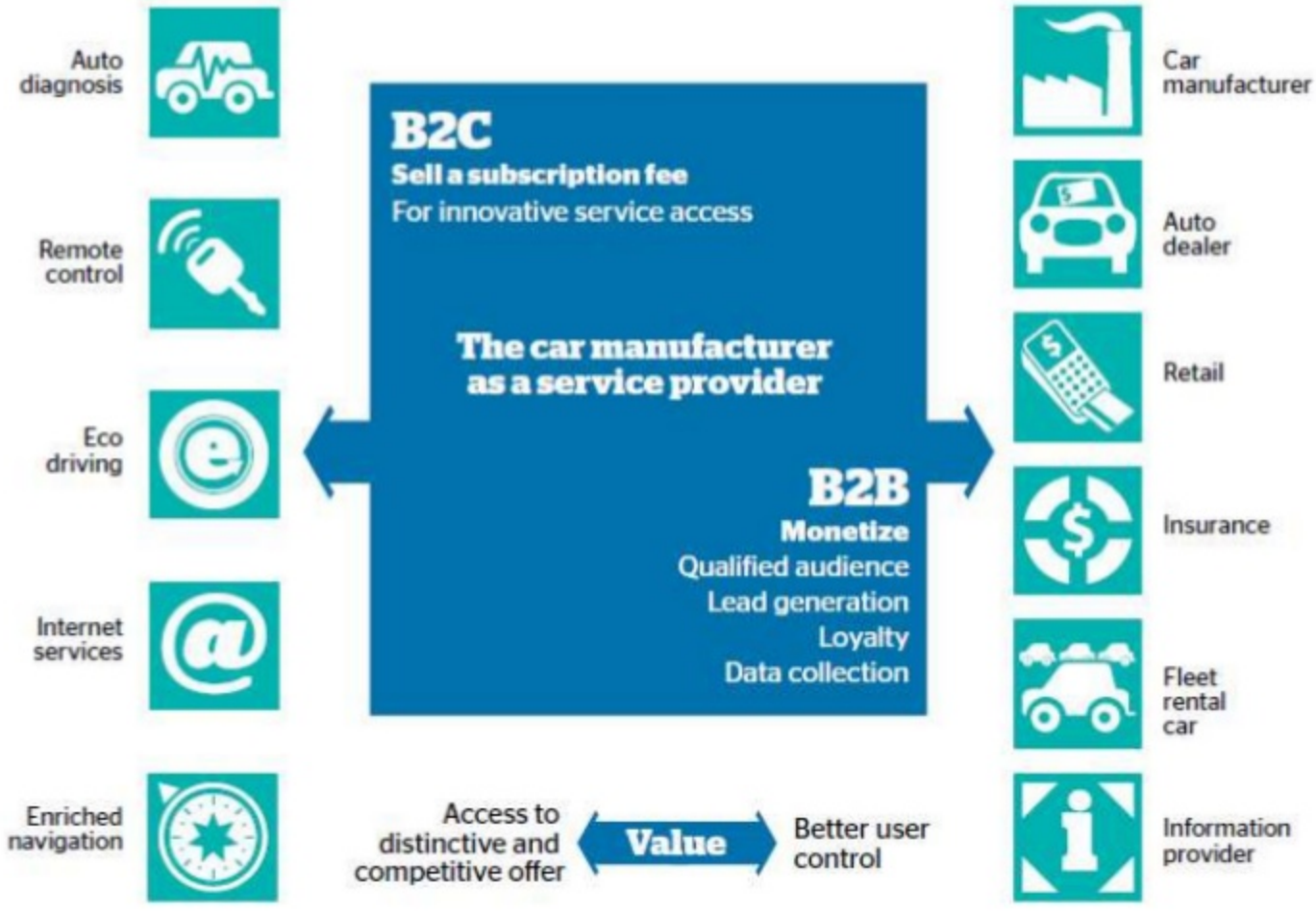
- **What data can be captured?**
  - Vehicle, software, system health or issues?
  - Navigation and location
  - Speed, braking, acceleration / deceleration
  - In-cabin settings and activity
- **Who can benefit from the data?**
  - OEMs and their supply chain
  - Government agencies (planning)
  - Insurers
  - Social media and marketing companies
- **Who owns the data?**
  - Driver / owner? Is it different in lease versus buy?
  - OEM?
  - Dealer?
  - Is it different for sensory data (braking, acceleration, etc.) versus location?
- **Jaguar Land Rover already has an answer to this - it's theirs**
  - JLR has a legal contract that the car buyer signs if they want the enhanced package of connected services. And this contract gives JLR the data - and the right to sell the data
- **Who will they sell the information to and at what price?**

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 Flows



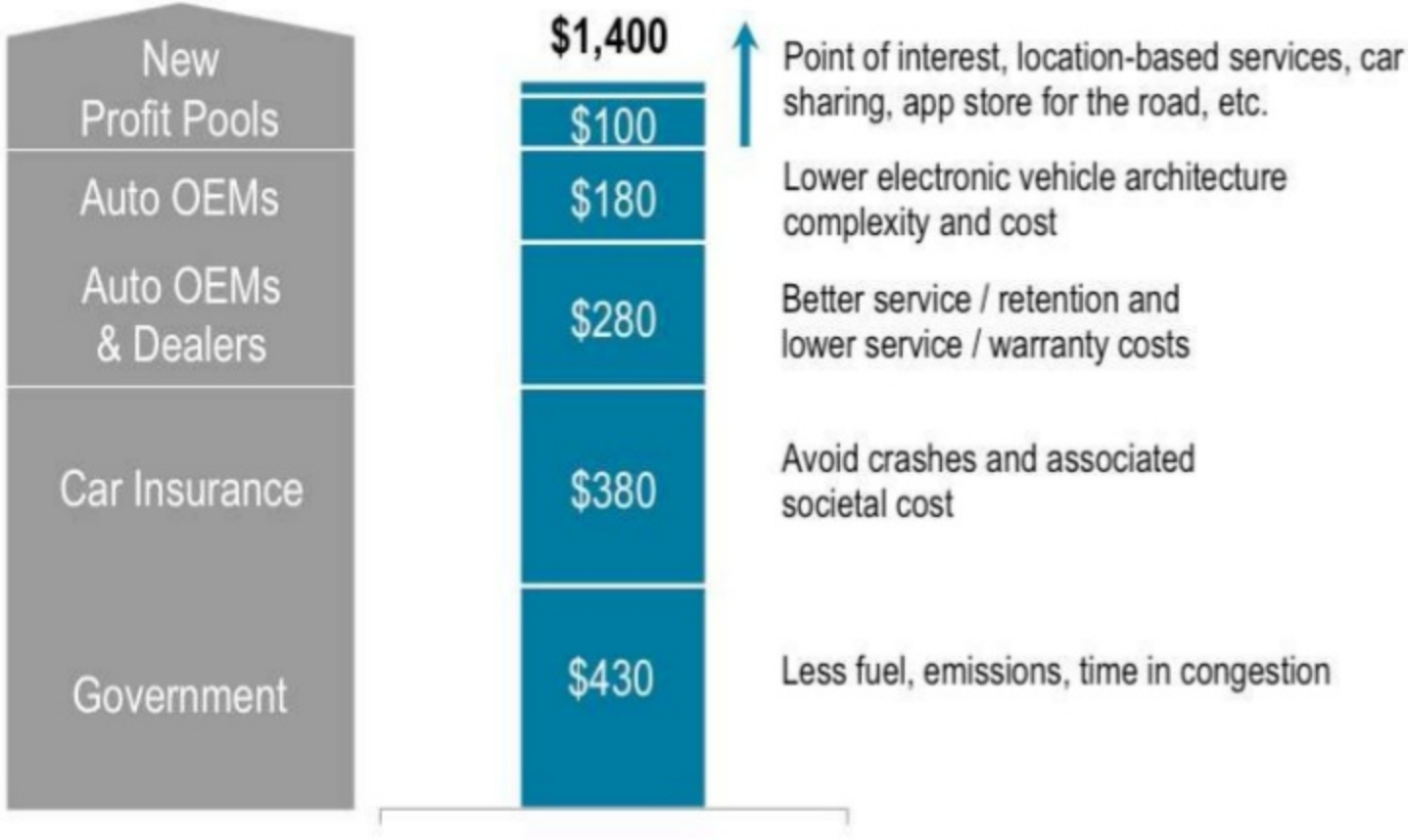
Although individual aspects of the connected driving experience are reasonably well-established, the integrated whole is not.

Source: Atos, Envisioning automotive futures connected cars for smart mobility

Revenue Potential

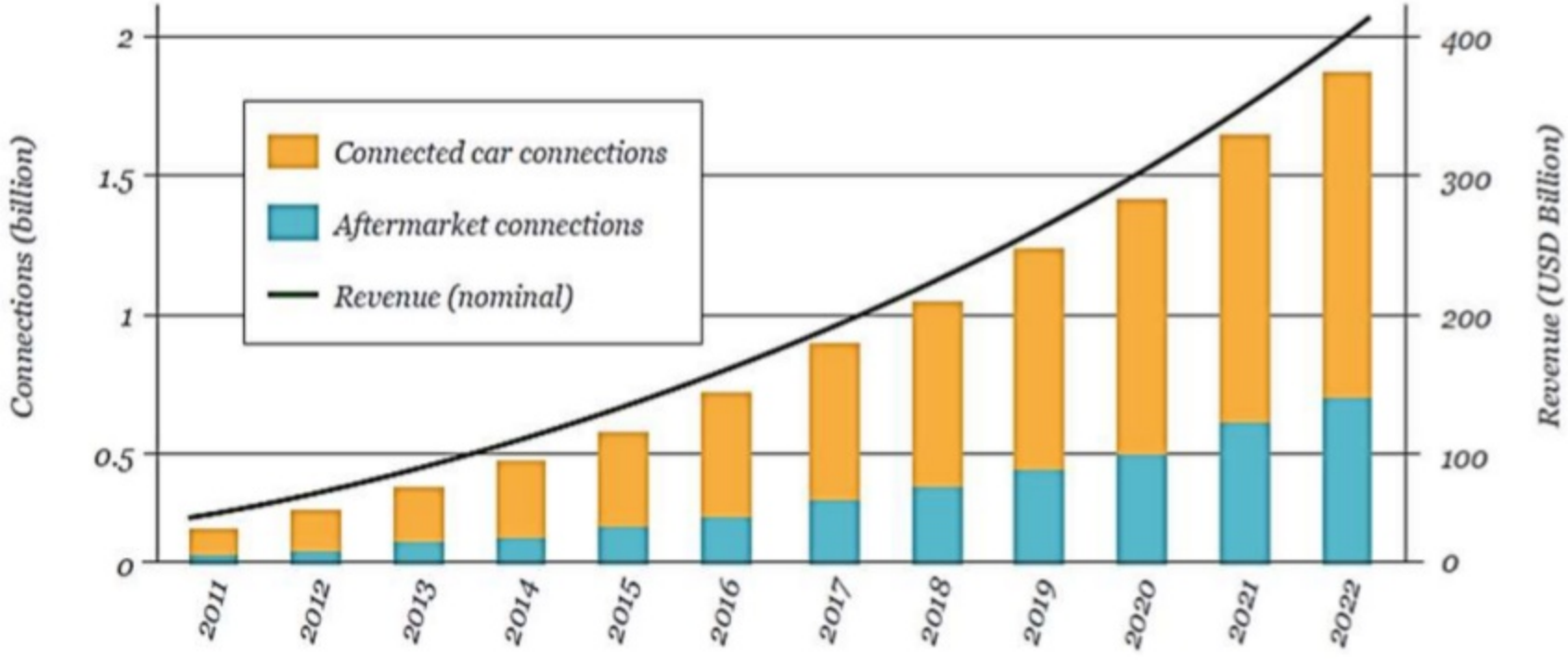
Unlocking $1,400 Benefits per Vehicle per Year by Connecting Vehicles?

Benefits of Smart Connected Vehicle By Source [US$/ Vehicle/ Year]



Source: Cisco

Revenue Potential



Source: Machina Research, 2013

Recent SW Recall Summary

Year	OEM	Vehicle	Issue	Units
2007-2008	Honda	Minivans	Brake software	344,000
2014	Jeep	Cherokee	Electrical spikes in central body software	4,500
2013	Chrysler	Minivans	Airbag SW	N/A
2013	Dodge	RAM 1500	Stability control SW	46,000
2013	Ford	LEVs	SW update to improve fuel efficiency	50,000
2013	Ford	Escape	Cooling system software	All
2012	Buick	LaCrosse	Brake SW	1,300
2012	Volvo	S60	Fuel pump SW	7,600
2012	Honda	Fit	Stability assist system SW	44,000
2011 - 2013	Chrysler	Various	Head restraint system software	500,000
2011	Cadillac	SRX	Airbag SW glitch	50,500
2011	Buick	LaCrosse	Electronic climate control SW	10,000
2011	Nissan	Leaf	Faulty SW	5,500
2011	Ford	Pickups	Integrated diagnostic system glitch	8,000
2010	Toyota	Prius	Brake control system SW	500,000
2006 - 2010	Toyota	Various	Acceleration issues	5,600,000
2005 - 2010	Honda	Accord, CRV, Element	Automatic transmission SW	2,500,000
2009	Cadillas	CTS	Passenger sensing system SW	12,660
2008	VW	Passat	Engine control SW	6,500
2006	Jeep	Commander	Automatic transmission SW	24,500
2005	Toyota	Prius	SW problem causes car to stall or shut down	160,000

Vehicle "Lifetime Design"

Lower Warranty Costs

- **Collection of real-time data, remote software updates, early detection of quality/design issues**
- **Over time, reduced need to over-engineer; better understanding of a vehicle's lifetime performance**
- **Roland Berger has estimated that OEM warranty/claim costs could be reduced by 30-50%**
- **Cisco has estimated 10% lower cost to service vehicles, including warranty savings**
- **"Remote diagnostics, predictive maintenance and, by that, reduced warranty cost are some of the most important parts in the connectivity business case, besides the traditional parts of revenue, like car and option sales". Mikael Gustavsson, Connectivity HUB Leader, Volvo**
- **A 15% reduction to global warranty costs adds 20-30bp of permanent margin to Ford & G**

Ford		2011	2012					
	Global Revenue	128,168	126,567	% Warranty Saved	5%	15%	30%	40%
	Global Warranty Expense	2,215	1,885	Margin Benefit	0.07%	0.22%	0.45%	0.60%
	% of Revenue	1.7%	1.5%	EPS Benefit	$0.02	$0.05	$0.10	$0.13

GM		2011	2012					
	Global Revenue	148,866	150,295	% Warranty Saved	5%	15%	30%	40%
	Global Warranty Expense	3,062	3,394	Margin Benefit	0.11%	0.34%	0.68%	0.90%
	% of Revenue	2.1%	2.3%	EPS Benefit	$0.07	$0.21	$0.43	$0.57

Source: Citi Research, GM/OnStar & Rise of the Connected Car (Part 4) – There's Money Here!, November 7, 2013

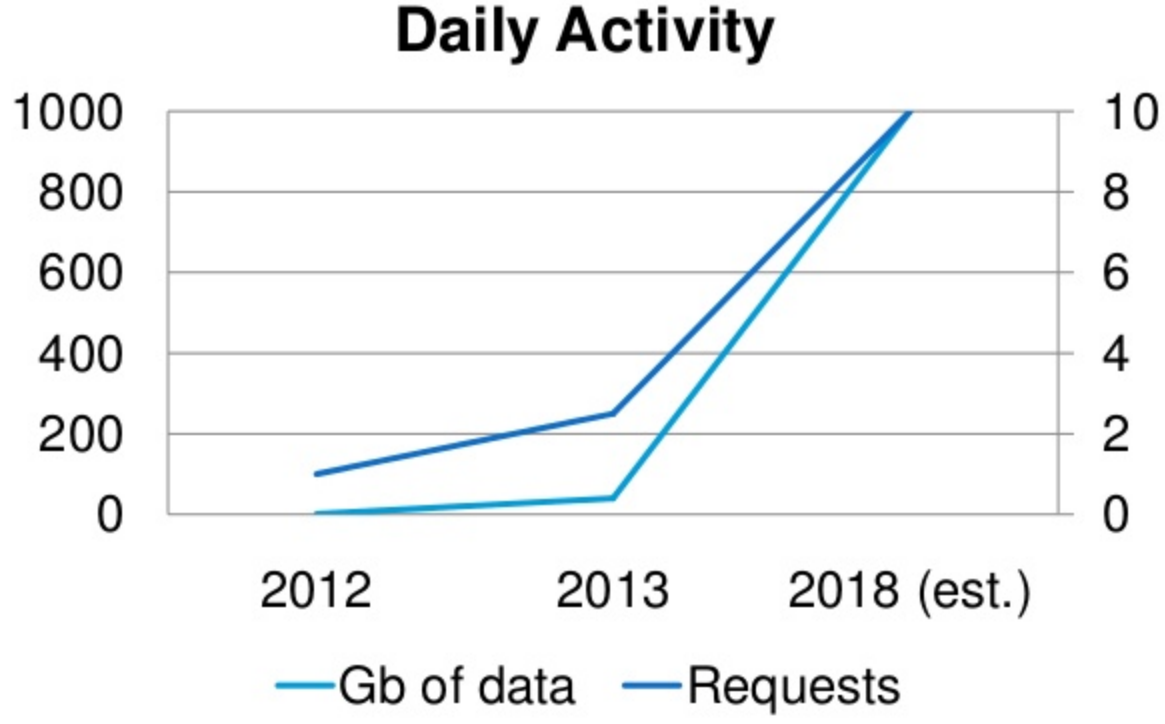
What are companies doing?

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
- Volkswagen partners with Apple on iBeetle, first car with fully integrated iPhone
- IBM And Sprint Team Up On Smarter Connected Cars
- AT&T, SiriusXM and Nissan collaborate on connected car initiative
- 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

OEM IT Cloud - BMW Case

- **BMW's Private Cloud Platform**
  - Private Cloud platform to satisfy internal requirements of zero downtime, resiliency, migration and interoperability with legacy software
- **Mario Mueller, VP of Infrastructure at BMW is the Chairman of Open Data Center Alliance**



Source: Mario Mueller at GigaOM's Structure Europe conference

Big Data and Analytics - IBM

- IBM and NXP worked with numerous partners to equip 200 vehicles with an advanced telematics solution capable of GPS/GSM/GPRS mobile communications, advanced security, and in-car connectivity.
- Connected cars provided the raw data, securely transmitting information from the car's internal network to the cloud-based IBM Smarter Traffic Center.
- Big data analytics extracted out the useful information, which was turned into driver updates through connected equipment ranging from smartphones to navigation systems.
- Over a period of six months, IBM's analytics uncovered 48,000 traffic-relevant events from 1.8 billion sensor signals. These ranged from heavy rain, ice, and pot holes to traffic black spots and the use of hazard lights.
- Feeding this information back to drivers in the trial, who had already been trained in smart and green driving (driving smoother, preventing accidents, and saving fuel), raised their "urban driving style" scores on average by 10%.
- In addition, almost 75% of the cars involved reduced their fuel