

# Intellectual Tech Envisioned

## Your Next Car Will Be Connected

### Safe Hookups: How to Bring Cars Online and Not Live to Regret It

A car that drives itself, à la Knight Rider, may still be a decade or so away from mass commercial reality. A car that operates fully connected to the Internet, however, could well be your next purchase. So, what does this mean for you?

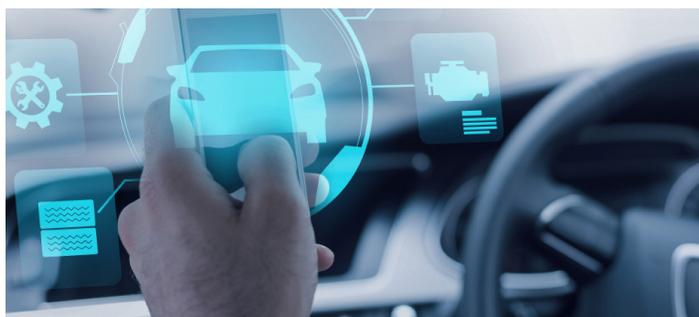
Within a few years, we will be able to solve many of the technical challenges of making a car whose engine, breaks, steering and other key components send data via a module to the cloud, according to the latest research by NTT DATA.

This opens the possibility to boost traffic safety, reduce the cost of owning a car, and add convenience to many aspects of automotive life, from finding a nearby parking space to cheaper refueling. It will also open the door to personalized infotainment systems.

In the U.K. alone, KPMG<sup>(i)</sup> estimates that connectivity enabled braking and lane assist technologies could save over 2,500 lives and stop 25,000 serious accidents by 2030. Already in the next year or so, German carmakers Audi, BMW and Daimler are promising to equip vehicles with a system that uses on-board sensors to warn drivers of potential hazards, road signage, traffic conditions, and even where to find available parking spaces.

More than 1 in 8 people consider internet access in a car to be a must-have, while more than 1 in 4 claimed that they prioritize connectivity over engineering specs, according to a McKinsey & Co. 2014 survey<sup>(ii)</sup> in the key auto markets of the U.S., Germany, China and Brazil. Demand for vehicle connectivity is rising each year, with the clamor for cars to be brought online strongest among the young and in developing auto markets such as China.

Connected cars – the “living”, moving embodiment of the Internet of Things (IoT) – are on the cusp of becoming mainstream. Last year, for the first time ever, U.S. wireless carrier net customer additions from IoT services like connected cars exceeded those from smartphones and tablets, industry researcher Chetan Sharma said<sup>(iv)</sup>.



Globally, the number of cars with mobile connectivity is likely to rise from 53 million in 2014 to some 237 million units by 2030, according to market researcher Fuji Keizai<sup>(v)</sup>. By that time the value of car data and shared mobility may exceed a trillion U.S. dollars.

### Connecting with Your Inner Car

What a connected car entails will expand with the years. Today, it's mostly limited to Internet access for driver and passengers. Soon, we'll see technology evolve to connect the car's engineering with the cloud. Beyond, we should expect cars to interact with each other, sharing information on traffic jams and weather conditions. The ultimate phase will come as cars hook up to the road and the wider environment, allowing signals, radars and cameras to synchronize traffic control, all the while monitoring driver health and awareness.

Not all these will roll out at once.

The scale of the undertaking is immense and we're not just talking about the cost of upgrading roads to make them “smart.” The state of Ohio in December 2016 said it will need to spend \$15 million to embed a 35-mile stretch of road with fiber-optic cable and sensors that collect and monitor traffic data. That's about \$429,000 per mile and the U.S. has 4.12 million miles of road, according to the Federal Highway Administration.

Yet the biggest challenge is surely in the scale of data this connectivity will create.

Today's car already collects 10 to several hundred kilobytes at a time from its Electronic Control Unit (ECU). With the arrival of self-driving automobiles that utilize image processing technology, that volume will surge by more than 100 times, according to NTT DATA.

Thus, a monthly car run of around 100 kilometers, which generates about 100 megabyte of data, would rise to 10 gigabytes in a self-driving car. If all the vehicles registered in Germany today, some 62 million units<sup>(vi)</sup>, switched to self-driving, their 100-kilometer journey would produce over 600 petabytes of data – double the current size of Facebook's Hive data storage warehouse<sup>(vii)</sup>.

If the numbers were not already staggering, let's consider this on a global scale. The world had 1.1 billion passenger and commercial vehicles in 2014 and industry forecasts point to that figure doubling in a couple of decades.

(i) Connected and Autonomous Vehicles - The UK Economic Opportunity, March 2015, KPMG (ii) What's driving the connected car, September 2014, McKinsey & Company (iii) How carmakers can compete for the connected consumer, September 2015, McKinsey & Company (iv) Chetan Sharma: IoT net adds exceed phone and tablets combined in Q2, with AT&T, Verizon leading, Aug, 2016, FierceWireless (v) Release of World market research of connected cars, January 2016, Fuji Keizai (vi) 2016 Germany: Total Number of Registered Cars, March 2016, Car Sales Statistics (vii) Scaling the Facebook data warehouse

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While some computers today have the processing power to handle this volume of data they are not tasked with moving at speed and with a human life inside them. After all, a bug in an OS can be fixed with a software update. You can't reboot software that's operating a machine hurtling at 100 km/hour.



## The Mother of All Data Challenges

The world may be one big data challenge, but what is the solution in this case?

One industry idea is to filter data. Not all the data a connected car will pick up will be vital to vehicle operations. The decision on what to keep and what to dispose of will partly rely on Artificial Intelligence. That's certainly the direction NTT DATA and its parent NTT Group is pursuing. The group sees AI as also ushering in an era of voice-operated car control and adding image interpretation to on-board camera footage.

Such advances should assist drivers to manage routes and traffic, while warning of danger on the road. AI could even be tasked with monitoring drivers for signs of illness or sleepiness.

Still, to make on-board AI work requires complex algorithms that pick out pertinent instructions from free-flowing human speech and also differentiate it from surrounding traffic noise. That, and the ability to detecting the speaker's language, is one of the key challenges today, according to NTT, which relies on its strength in mathematical analysis to tackle similar problems.

An even graver challenge will be how to protect connected cars from intrusion. A hacked car could spell mortal danger for passengers, especially as the option of transmitting system patches while the vehicle is in motion may be impossible.

As NTT DATA sees it, there are two issues to overcome. One is building defenses against cyber-attacks, for which the challenge

is distilling vast volume of security know-how that companies like NTT DATA have amassed into a compact device for usage inside the car.

The other issue is prompt detection of intrusions using big-data statistics. This involves studying the logic of detecting abnormalities as well as a multilateral analysis of data from a moving vehicle's ECU.

## Piecing Together the Puzzle

As cybersecurity systems are just one of many that will populate connected cars, the ability to manage the hundreds of engineering and IT technologies will become the ultimate puzzle for connected cars.

We will need to develop a platform that pulls together the tech of various car and auto parts manufacturers, as well as one that organizes and combines multiple in-car communication standards, which already include mobile, Ethernet, CAN (Controller Area Network), LIN (Local Interconnect Network), MOST fibers and high-speed FlexRay.

Any delay or loss of data "could have major safety effects" on driving, U.K. telecom company Spirent said in a 2016 connected car report <sup>(viii)</sup>.

For NTT DATA this could be a business chance. The company has traditionally worked on projects that involve creating platforms that organize and manage large-scale social infrastructure, such as the core banking system for local lenders in Japan. The parent, NTT Group, has its own AI offering that competes with IBM's Watson.

Plus, in recent years NTT Group has made a string of acquisitions in cybersecurity space and partnered with various IT and automotive firms to develop both software and hardware solutions for the connected car.

Still, it feels as if some challenges, may be beyond even the best R&D departments.

If connected cars with AI assistance are able to log all motion all of the time, then what happens when you want, for example, to take a secret trip to a jewelry store? After all, you might not want your girlfriend to learn of your romantic intentions from the on-board computer.

(viii) What's Driving the Connected Car?, SPIREN