



PROTEAN

On The Journey to Future Transportation

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Views from our CTO

Dr. Chris Hilton, CTO

The ongoing revolution in Transport-as-a-Service (TaaS) is generating excitement and nervousness across a few industry sectors, which is a good basis for interesting times for engineers. Meanwhile the general public is largely unaware of the changes coming their way although they're already experiencing the first elements. If we get this transition right, it could have profoundly positive effects on society.

Transport-as-a-service is not new in a literal sense but in the past we've been content to refer to it variously as buses, trains, trams, taxis, aeroplanes and rickshaws. In enlightened corners of the world a single ticket may give a passenger access to a range of modes of transport for travel in a particular zone and a journey can be planned and booked via a mobile phone app from origin to destination. This starts to look more like a customer-needs oriented transport service and these are the first elements of what is generally meant under the heading "TaaS" today.

So why the excitement now when we already have this stuff and it isn't achieving a great deal other than a bit more convenience? The answer is that a collection of new technologies are maturing that will have major impacts on both the mobility of people and goods, and on the businesses that will provide the solutions. For the most part these technologies are not the natural areas of expertise for the traditional automotive industry which is making life for strategists and decision-makers in such companies interesting. Firstly, there's connectivity in the form of the ability of devices such as phones and vehicles to communicate with each other and to access huge volumes of up-to-date data stored online. Secondly, there's autonomous driving for which the key ingredients are artificial intelligence, sensing, connectivity and data.

Finally there are electric vehicles and the charging infrastructure to support them.

Maximising time, cost and comfort

We've become used to using our phones to arrange transport through apps which plan routes, buy tickets and track the progress of planes, trains and automobiles. This is convenient and reassuring but does not change our journeys much in terms of the parameters that matter to us: time, cost and comfort. Nor do they bring mobility to those for whom that's currently a problem. Likewise, electric vehicles are becoming familiar and even the most resistant of the car manufacturers are now proudly presenting roadmaps to an all-electric future to be reached before the middle of this century. That's great for the future of our planet and for the health of city dwellers and should also bring comfort and some cost advantages in the longer term but it won't much change who or what is served by TaaS. The really significant opportunities and changes will come with the advent of autonomous, i.e. self-driving, vehicles.

At first sight the idea of our vehicles driving themselves will be upsetting to many, especially to those of us for whom having independent transport in the form of a car was a major life milestone and for those who find driving pleasurable, at least sometimes. I suspect though, that in the future we'll look back and wonder how we ever thought it was sensible to put a human in charge of a couple of tonnes of metal travelling at high speed in close proximity to other humans. A human that might be tired, intoxicated, distracted and has no idea what the other humans controlling the other metal boxes are planning as their next move. You can spend a lot of time thinking about what will change with self-driving cars. The impact I

want to focus on is to Transport-as-a-Service.

Benefits of TaaS

Let's start by simply imagining that the vehicles we use today become self-driving and, as part of that, they communicate with one another and make use of other data around for journey planning. Journeys will be safer and more predictable. More significantly, TaaS journeys will be significantly cheaper for at least three reasons. Firstly, there's no driver to pay. Secondly, the coordination aspect of the community of autonomous vehicles enables efficient ride-sharing. Thirdly, money will be made from the data delivered to and from the passengers. It's this cost advantage that will make TaaS viable where it currently isn't. Running a bus with a driver to remote places or along rarely used routes or from destinations where no one can afford the ride will be loss-making. But without a driver more routes make economic sense and similarly taxis become more affordable.

In fact vehicles that we might call "urban mobility pods" are foreseen as part of this ecosystem, primarily for first and last mile journeys. These are like small buses or large taxis, typically carrying a few passengers, and there's plenty of publicity from companies such as Local Motors, Bosch and Schaeffler developing them as they try to position themselves as leaders in this important new area of transportation. Much of the imagery used shows such vehicles serving young, fit professionals in modern city plazas surrounded by glass-fronted office buildings. They have their uses there but hopefully the greater impact will be in the ability to provide mobility to people currently on the fringes of society due to disability or location or lack of money. It's pleasing to hear many people and organisations addressing this opportunity, including city planners.

If you've read this far then you've probably forgotten by now that I'm the CTO of a company that develops electric motors (particularly excellent ones, of course) and now that I've reminded you, you may be wondering what this TaaS and autonomous vehicle stuff has to do with us at Protean. It's partly because I happen to be fortunate enough to be party to conversations on the subject and it's fascinating to consider what

the future of transportation will hold. But mostly it's because there are two desired features of the urban mobility pods that point to in-wheel electric motors as the powertrain of choice. Firstly, they should be highly manoeuvrable, able to move in all directions and spin on the spot. You will struggle to achieve that with axles. Secondly, we'd like the fleet of such pods to contain vehicles of various designs adapted to specific purposes. For instance, some vehicles will be adapted to be easily usable by people in wheel-chairs or with push-chairs. They will have low, flat floors and easy access from all sides. Some will be adapted for commuters, some for shoppers and some for delivery of goods. Some for short distances, primarily people standing, and some for long distances, with comfortable spaces. This becomes feasible if they are built on a largely common platform which leaves maximum usable space and minimal obstructions. The answer to that is to create a skate-board like base for the vehicle in which the floor contains the battery and all the propulsion, stopping, steering and suspension is carried out by modules at the corners. That is what we're working towards with our partners and other enlightened companies are heading in the same direction. Feel free to draw the conclusion that in-wheel motors will greatly benefit society.

If you're driving a car with Advanced Driver Assistance Systems (ADAS) like adaptive cruise control or collision avoidance then you're at the beginning of a revolution that will lead via fully autonomous vehicles to transformative Transport-as-a-Service that will improve mobility and so opportunities for many of the approximately 85% of the human race that have no car to drive. It's going to be an exciting journey.

About the Author

Dr Chris Hilton has been at Protean for over a decade and CTO since 2012.

Views from the CTO provides perspective on automotive trends from a market-leading industry innovator.



