New Mobility Paradigm

Planning for transportation-as-a-service

By Bern Grush & John Niles

Some observers suggest that we are on the cusp of a tsunami of automotive innovation that will enable relief from the congestion, carnage and environmental harms of the automobile. Others warn this technology portends a new wave of problems. Since this road could fork either way, planning for the next 20 years will be very challenging…or worse. So, what's your plan?

Governments are urged to prepare for autonomous vehicles. But prepare for what? An increase in household vehicles or more ride sharing? Less congestion or more vehicles deadheading? The end of parking or empty vehicles circling while waiting for owners to finish shopping? The end of bus-transit or the beginning of soaring ridership on autonomous transit?

Patterns of future vehicle ownership will be decisive, but now we can only speculate. Given the current profusion of assumptions, claims, exaggerations and warnings, governments cannot be sure what to get ready for—or when.

Better plan: Urban leaders decide what they want AV technology to do for their cities—in other words decide what's in the public interest. Ask not what municipalities can do for AVs. Tell AVs what they can do for municipalities.

AVs are robots; we can specify what we want them to accomplish. If municipalities do not tell AVs what to do, then Uber will. Uber's CEO has already said as much and has demonstrated that Uber can be both pervasive and persuasive.

Transportation-as-a-Service is the transit of the future whether run by cities or corporations.

If Ontario's cities use AV technology to expand transit coverage and ridership, frequency and convenience, flexibility and service options, then a tsunami of positive change is possible.

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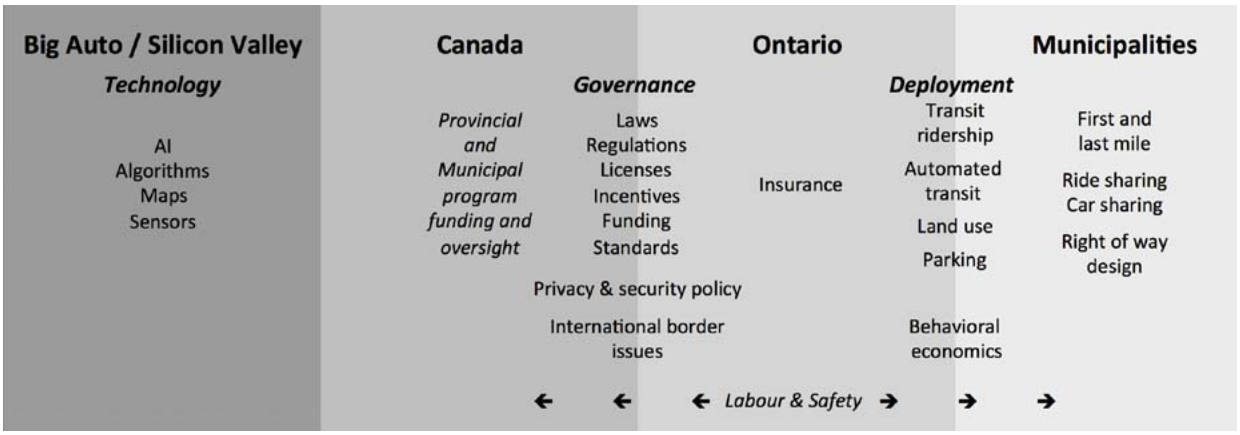
Where are we, right now?

Every day we creep nearer to robotic vehicles that handle most situations encountered, but we remain far from vehicles that handle everything everywhere. The final 10 per cent of any technology development consumes 99 per cent of our inventive efforts. A household vehicle that can go driverless, at posted speeds, on any road household vehicles use today does not yet exist.[1]

As of 2015, we have entered a sobering few years of reality checks about the AV that needs no human supervision.[2] Sending your 8-year-old to ballet or hockey without a human driver is farther off than most believe. So is deadheading, the end of parking, and the self-arriving robo-cab. There are a tremendous number of valuable Advanced Driver Assistance Systems improvements in the offing but none that change the current ownership paradigm.

One concern: Quasi-robotics make highway and congested driving more tolerable, increasing our willingness to commute farther. What will this mean for highway exit ramps emptying into Ontario's cities? For urban parking infrastructure, much of it over-demanded and under-charged? For rail networks and transit-oriented development? What if increasingly sophisticated Advanced Driver Assistance Systems were all that were deployable until 2070, as pioneer Steve Shladover predicts[3] (i.e., no quantum leap in household transportation that indicates infrastructural change)?



Sample of key policy vectors for autonomous vehicles. Some things, such as automated transit, straddle a couple of levels. Others, such as labour and safety, are influenced at all levels

What should governments do?

Our three levels of government will play different but interconnected roles in robotic transportation. None of these governments need spend on technology R+D, which is advancing quickly in Silicon Valley, Detroit, Europe and Asia. But if Ontario wants regional economic returns and to address the transportation snarls of its cities, then it must go beyond promoting early AV innovation to facilitating early adoption. Markets enable the social benefits of new technologies.

The best way forward for governments is to invest in deploying newly-enabled forms of automated transit services as a first step in moving toward autonomous transit vehicles. Deployment targets should aim to increase transit ridership by a factor of three by 2030 and eight to 10-fold by 2045. This would have several effects: Give transit an advantage in providing the user experience of robotic transportation; Support early, low-cost autonomous transit options before household AVs are deployable; Increase the portion of travellers that perceive robotic public transportation as more suitable than owning a vehicle.

What should Ontario do?

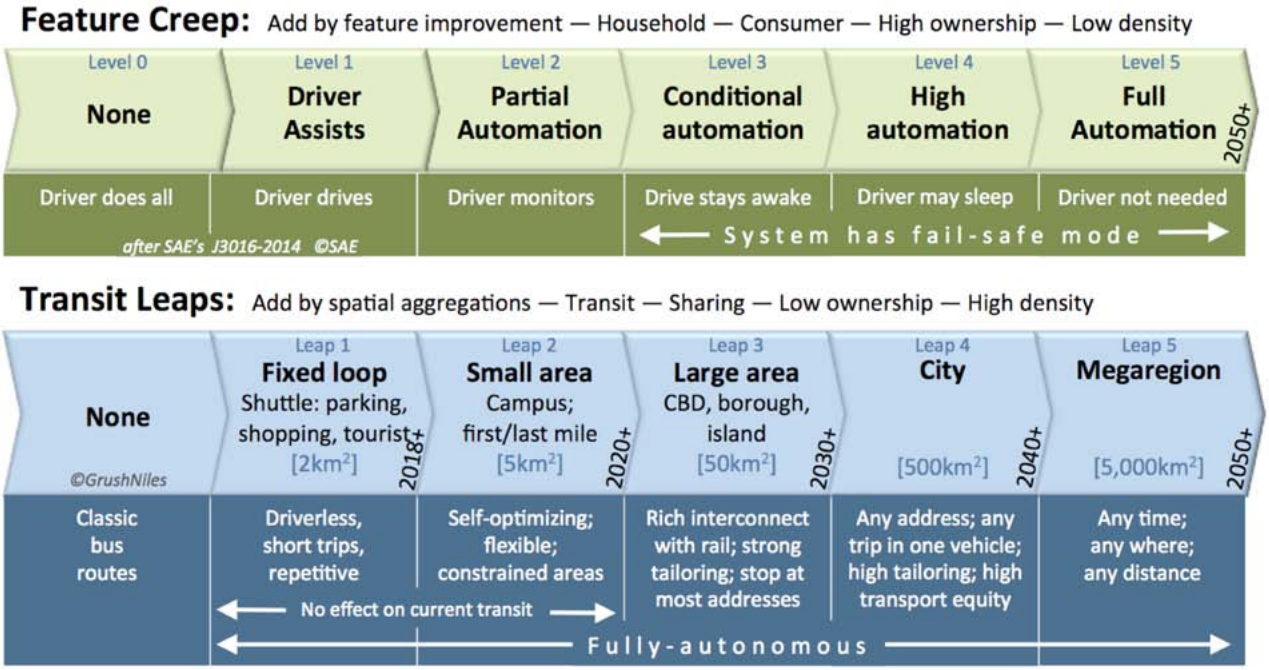
Ontario should move forward with autonomous transit rather than wait for the driverless private automobile to be perfected. Just as the barriers to the household market for Level 5 autonomous vehicles are becoming apparent,[4] the application of robotic vehicles for public transit is being implemented. Already there are successful trials of non-rail, free-moving, autonomous minibuses being used on constrained routes and limited networks in the UK, EU and Singapore.[5]

At the same time, the private sector is quickly developing its own transit routes, still driven by human drivers, such as Chariot and UberHOP. One can easily imagine these commercial routes persisting—and expanding—as operating costs drop during the transition from route-constrained to fully-capable robotics.

Robotic service applications on limited routes can more easily overcome barriers faced by early, access-limited, self-driving household vehicles. This enables the autonomous vehicle to both disrupt household ownership and find an important niche in disrupting transit—and enabling plenty of support jobs to replace vehicle operator jobs.

By their nature, public transit vehicles are limited in spatial range and are constrained to fixed routes. Targeted, affordable, roadway preparation can be associated as autonomous transit applications and routes are mapped and prepared one-by-one within constrained areas and routes. Gradually, Ontario cities would experience expansions of robotic, on-demand shuttles and taxis. With growing ridership, user fees could support public-private partnerships as investors and fleet managers. Driverless vehicles in public service mean long daily use cycles such that high turnover could maintain Ontario's automotive manufacturing jobs.

Significant instances of robotic service applications can be realized in Ontario in the early 2020s.



Feature Creep as expressed in the five-level autonomous vehicle standard, J3016 from the Society of Automotive Engineers (SAE). Only the level 5 vehicle is fully autonomous (no driver controls needed); [caption - bottom] five levels of *Transit Leap* spreading autonomous usage by controlled spatial extension rather than by randomly distributed consumer purchases. All vehicles in Transit Leaps 1 through 5 are fully autonomous SAE Level 5 vehicles.

Transit Leaps

Transit Leaps like quantum leaps are dramatic rather than incremental shifts. Transit Leaps refer to public-use, robotic, shared-mobility applications that start small, expand by demand, grow, merge and spread. The core motivation for Transit Leap is to accelerate the arrival of robotic mobility as a social good, while expanding transit ridership and concurrently reducing the demand for household vehicles.

Transit Leaps introduce robotic vehicle mobility to the urban landscape, application-by-application and area-by-area rather than car-by-car or owner-by-owner. The latter has already started with Feature Creep technology releases such as Tesla's ADAS and Volvo's planned Level 3 autonomy pilot for Gothenburg in 2017.

With spatially-constrained robo-transit, progressive, urbanized regions can jump quickly and directly to fully autonomous vehicles, with meaningful social applications for SAE Level 5 vehicles. Initially courteous, deliberate, cautious and slow, these vehicles address user anxiety and safety while avoiding the distracted-driver issue plaguing semi-autonomous, pre-Level 5 vehicles.

What can Ontario municipalities do?

A first step for any municipality is local first/last kilometre applications expanding gradually and opportunistically into larger, still constrained areas. While the first Transit Leap project for a city would likely be its most difficult, as experience builds these applications merge and grow into urban-wide, then region-wide systems, through a connected series of increasingly flexible and capable extensions incorporating incremental AV technology improvements suited to each application.

The changing nature of public transit employment would result in growth of non-driving jobs. If, for example, a transit agency were to quadruple its ridership using autonomous vehicles, the labour contingent required to manage and service a tailored and responsive fleet for service could double its workforce.

Expansion of the geographic reach of autonomous Transit Leap vehicles will continually erode the need for vehicle ownership. Peak car ownership becomes declining car ownership. Stagnant transit ridership and the threat of public agency job loss become growing ridership and expanding mobility industry employment.

Robotic transit can't be stopped

Autonomous vehicles are bound to disrupt both public transit and the use of public-access shared vehicles. The opportunity for Transit Leaps lies in leveraging this disruption to increase transit ridership whether by robo-bus, robo-shuttle or robo-taxi.

Under a Feature Creep paradigm of household ownership of AVs, transit will be negatively disrupted. A future robotic offering by Uber competing with a laggard offering from municipal transit will mean a decline in transit's viability in providing equitable mobility for all income levels. Uber's CEO Travis Kalanick is on record saying he will provide better transit. The choice facing Ontario's municipalities is whether to abdicate or grow transit.

The massive, 120-year-old automotive industry is premised on making and selling a consumer product. Those commercial enterprises will remain and continue to build vehicles better and cheaper—and in greater numbers. The ethos of the status machine, the personal and private machine, the convenience machine, and the fast, sleek-and-sexy machine will linger as will consumer predilections for owning one.

The automotive Feature Creep business model erodes the comparable, already-disadvantaged appeal of transit. Our business-as-usual world aspires to a "car-in-every-garage," but in the Transportation-as-a-Service world there is a "ride-for-every-need." Removing the driver from the private car is an enabler for more affordable transportation service, but may be a step backward if Ontario and its municipalities "wait and see" while the automotive manufacturers prepare better and better vehicles for household consumption rather than for Transportation-as-a-Service consumption.

The path to the oft-predicted, smart urban future of any-time, on-call, mobility-on-demand will be easier to traverse and come sooner where the Transit Leap paradigm is deployed. Ontario's transportation leaders should not dither in the face of AV technology hype, hope and fear. Rather, our city builders should begin implementing what is already feasible starting now.

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Endnotes

1 Grush, B., Niles, J. (2016) *How cities can use autonomous vehicles to increase transit ridership and reduce household vehicle ownership.* For presentation at the Canadian Transportation Research Forum, May 1-3

2 Grush, B., Niles, J. (2016) Getting past the hype: What Gartner's Technology Hype Cycle teaches us about the autonomous vehicle. Thinking Highways, March 2016. Available at: http://endofdriving.org/wp-content/uploads/2016/02/What-Gartner%E2%80%99s-Technology-Hype-Cycle-teaches-us-about-the-autonomous-vehicle.pdf

3 Shladover, S. http://uccs.ucdavis.edu/AutomationPolicy_UCSactoCompatibilityMode.pdf Slide 22

4 http://endofdriving.org/2015/11/30/the-autonomous-vehicle-will-develop-in-a-wave-of-tech-disruptions/

5 http://endofdriving.org/2015/11/12/transit-leap-autonomous-vehicles-and-transit/