The Future of Urban Transport & Metro’s Mobility Strategy
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With the rise of shared mobility and vehicle automation, we are on the cusp of an equally profound and equally swift revolution in human mobility as that of the early 1900s.
Automation and Vehicle Size

• All Autonomous Vehicles are NOT created equal

• Light Duty Vehicle (LDV) Automation – Passenger Car

• Heavy Duty Vehicle (HDV) Automation – Commercial Truck

• Transit Bus Automation

• Each with different economics, incentives, business models and technical challenges
Light Duty Vehicle (Passenger Car) Automation in Context

- Shared mobility, electrification and car automation, each can and does exist on its own.
- But together, they can lead to a flywheel effect – technically and economically.
- Important to think of each in the context of the others.
Shared Mobility (Ride-hailing) Needs LDV Automation

- Ride-hailing (Uber, Lyft) – One of many modalities of Shared Mobility
- Rapid and meteoric rise faced with:
  - Negative margins
  - Driver supply issues
  - Growth ceiling
- Needs AVs to achieve sustained growth and positive margins

"Autonomous cars are the only way to get the cost down" from $2.50 per mile for a typical UberX ride to $1 per mile, a level that would tempt city and suburban residents to stop owning cars. - Uber CEO Dara Khosrowshahi at Goldman Sachs conference in February 2018
LDV Automation Becomes Viable with Shared Mobility

- A typical car today is parked 95% of the time
- Makes individual ownership of Autonomous LDVs impractical
- Fleet based ownership providing on-demand mobility service
- The shift from ‘productization’ to ‘servitization’ to ‘securitization’ is critical to making the economics of LDV automation work
Levels of Vehicle Automation

Level 4 automation is expected to make self-driving cars viable in urban environments

Key Distinctions & Examples

- Completely manual
- Most cars pre 1990

- Cruise control
- Most cars since 2000

- Adaptive cruise control + self-steering
- Most luxury cars today

- Adaptive cruise control + self-steering at most times
- Tesla Autopilot

- Full autonomy – mapped areas only
- Waymo AV service live in Phoenix

- Full autonomy – anywhere, in any conditions
- Unlikely to be available for several years
Implications of Ride-hailing for Transit and Congestion

- The meteoric rise of Ride-hailing
- Faster, more flexible and convenient than transit, taxis and SOVs
• Uber and Lyft are adding car trips to city and suburban streets, and in many cases, cannibalizing transit – UC Davis Research Report covering 7 U.S. Metros.

• TNCs are pulling from, not complementing, public transit and contributing to slower traffic - Analysis by Bruce Schaller in NYC and MAPC in Boston.
• 40% of Uber and Lyft rides in the 39 city region taking place in just four neighborhoods of City of Seattle…
• … that are already densest, most congested, as well as best served by frequent transit, bike lanes and walkable streets
Implications of Autonomous LDV based Ride-hailing (AV Taxis)

- Autonomous LDVs will improve safety, roadway capacity, and enable cheaper travel and more productive use of time.
- Autonomous LDVs will also lower Ride-hailing costs and could exacerbate the shift away from high capacity and active transport.
- How many elephants can you fit in a wineglass? How many AV taxis on a city street?
Implications of Autonomous LDV based Ride-hailing (AV Taxis)

To solve for the geometry of dense environments

- Transport people in large vehicles (aka Transit)
- Or get them to ride vehicles no larger than themselves (bikes, scooters)
The Ridership-Coverage Tradeoff of Transit

- Competing demands of **Seeking Ridership** (service where lots of people ride) Vs. **Ensuring Coverage** (service to ensure that everyone can ride)

- Only 50-60% of transit is ridership seeking; The more coverage service you offer the less ridership you can seek

- Transport use cases and implications for the ridership vs. coverage tradeoff

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- Shared Mobility and LDV automation can complement rather than compete with transit and its cities’ and transit agencies’ job to ensure that it does
Two Futures

Marginalized transit

- Shared autonomous LDVs draw riders from transit
- Higher VMT, congestion, and energy use
- Personal convenience; missed societal benefits
- Transportation gets highly inequitable

Transit at the center

- A transport network with transit as the backbone
- Autonomous LDVS complement transit
- Fewer vehicles; Lower VMT, congestion, and energy use
- Lower overall system costs and more equitable access
Getting to the Desired Future State – Metro’s Strategy

- Partner with shared mobility for improving coverage (Last mile and low density)
- Enable integrated multimodal transportation
- Improve transit quality and focus on ridership (Dense urban and intercity suburban)

- Network redesign
- Dedicated lanes and signal priority
- Operational efficiencies and effectiveness
- Technology (including transit bus automation)

- Ride-hailing
- Shared bikes and scooters
- Micromobility
- Use-case based subsidies

- Road pricing
- Data sharing standards
- Integrated trip planning and payments
State of Full-sized Transit Bus Automation

Economics of Bus Automation
• Smaller commercial opportunity compared to car and truck automation
• Not enough Public R&D funding

Technical challenges with Transit Bus Automation
• Modifications, replacements or redesign needed to transfer existing automation systems from sensing and propulsion to steering and braking
• Time horizon for Level 4 autonomy unclear

Will the U.S. lead?
• Testing in Shenzhen, China
• Full-sized driverless buses slated on a 14-mile route in UK by 2021
• Five 40 seater buses to be converted from manual to autonomous by Fusion Processing, with £25m in state funding
Full-sized Bus Automation would be a Game Changer

- Space efficiency of large vehicles with dramatically lower operating costs and increased safety

- Vehicle right sizing by passenger demand could unlock further efficiency gains

- Cost structure reversal (Form opex to capex)

- Loss or reclassification of operator jobs

- Public vs. private operations
Metro’s Efforts to Date

• Several ‘New Mobility’ pilots deployed/ under development (including Microtransit, Ride-hailing, Bikeshare for First & Last Mile and low density)

• Not enough interest in 7 to 14 passenger AV shuttles (Navya, EasyMile, May Mobility) due to speed, range and gradient limitations

• Regional cities interested but wary about AV Taxis
• Most providers of self-driving cars not ready for commercial deployment on city streets; ETAs are a moving target
• Waymo’s First & Last Mile service in AZ off to a shaky start
• Seattle’s light rain and mist can pose additional technical difficulties

• Metro interested in bus platooning for BRT and in-depot automation; Limited traction from OEMs; exploring FTA grant application
Q & A

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