

The Future of Transportation Technology: How to React

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Agenda

- Automated Driving
- Ride Hailing
- Technology and Transit
- Sharing Economy



Goals

1. Understand how technology is reshaping transportation across globe
2. Discuss tech's potential and limitations
3. Create insights into how technology will affect transportation here

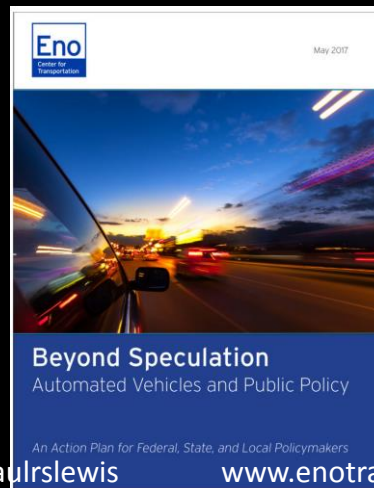
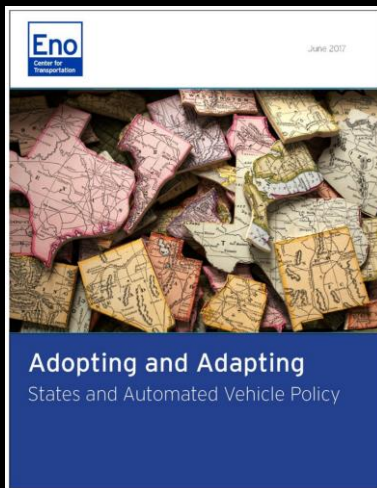


About Eno



References

- Reports available on Eno's website
 - *Beyond Speculation*
 - *Adopting and Adapting*
 - *Emerging Trends in Transportation Technology*
 - *Eno Transportation Weekly*



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Agenda

- **Automated Driving**
- Ride Hailing
- Technology and Transit
- Sharing Economy



AV Summary

AV Summary

- AV has advanced rapidly on the “easy” part of the problem
- Safety (in rural areas) has most to gain in short term
- The future is far from known, but we can begin planning now

What is an automated vehicle?

- Self-driving?
- Driverless?
- Driver assist?
- Automated?
- Autonomous?
- Cars? Trucks? Buses?

SAE Levels of Automation

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability (Driving Modes)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	System	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the dynamic driving task with the expectation that the <i>human driver</i> will respond appropriately to a <i>request to intervene</i>	System	System	Human driver	Some driving modes
4	High Automation	the <i>driving mode</i> -specific performance by an automated driving system of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a <i>request to intervene</i>	System	System	System	Some driving modes
5	Full Automation	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	All driving modes

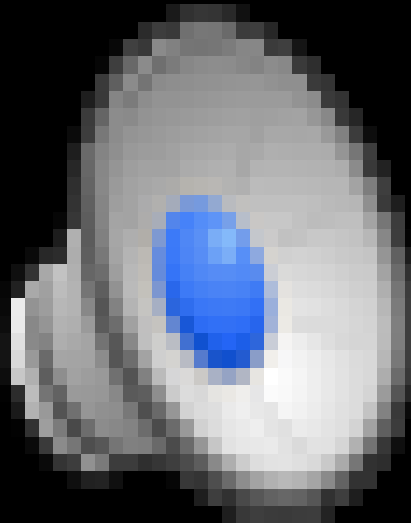
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What will happen?

- Vehicle miles traveled
- Congestion
- Safety
- Liability
- Privacy
- Ethics



Automated Driving



AVs in Arlington



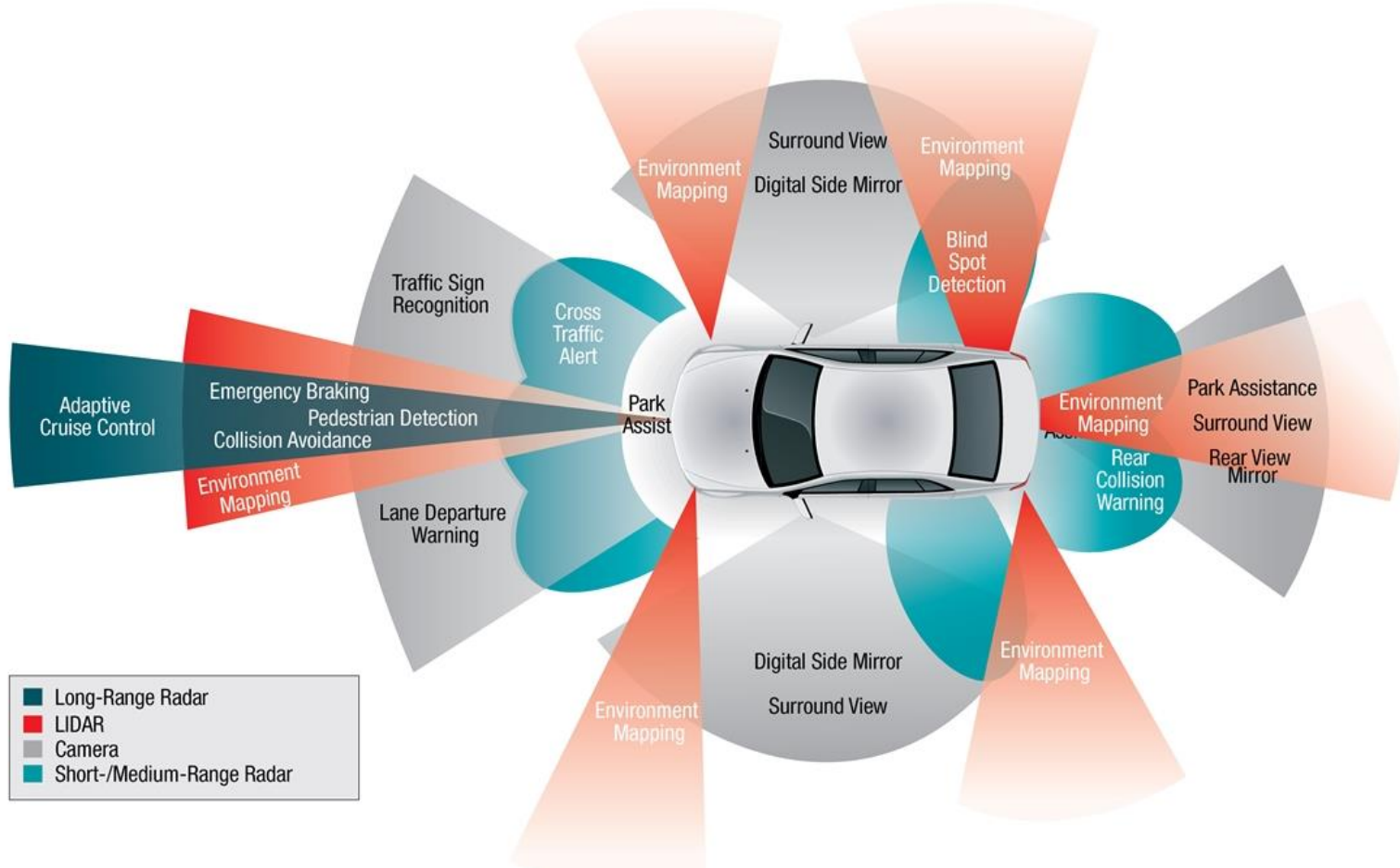
Adam Tuss 📍 @AdamTuss · Aug 7

Alert!!! We found the supposed self driving van in Arlington - and there's a guy hiding behind the seat!!! @nbcwashington

Approach to Automated Tech



Current AV approach



Expected Commercial Availability

Table 2: Expected Commercial Availability of Level 3 or Higher Vehicle Automation, by Select Organization

Organization	Year	Type of Organization	Automation Level
Ford Motor Company	2021	Vehicle Manufacturer	Level 4
Uber	2021	Transportation Network Company	Unspecified
Volvo	2021	Vehicle Manufacturer	Level 4
General Motors	2020	Vehicle Manufacturer	Unspecified
Tesla	2018	Vehicle Manufacturer	Level 3 or 4
Google	2020	Technology Company	Level 4
Victoria Transport Institute	2020-2030	Research Organization	Unspecified
National Association of City Transportation Officials	2020	Association	Level 4
IHS Markit	2020	Market Research Company	Level 4 and 5
ABI Research	2021	Market Research Company	Level 4 and 5
Juniper Research	2025	Market Research Company	Unspecified

Source: Endnotes 10 - 20.

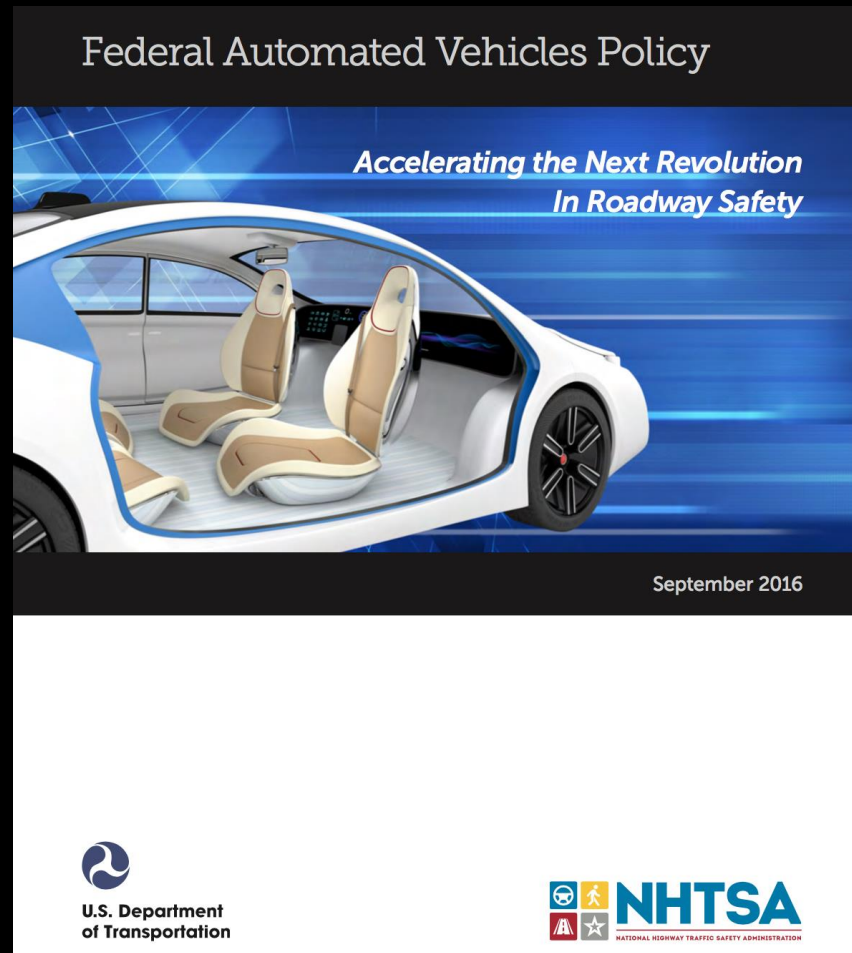
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Business Model

- Personal AVs
- Shared fleets



Government Role



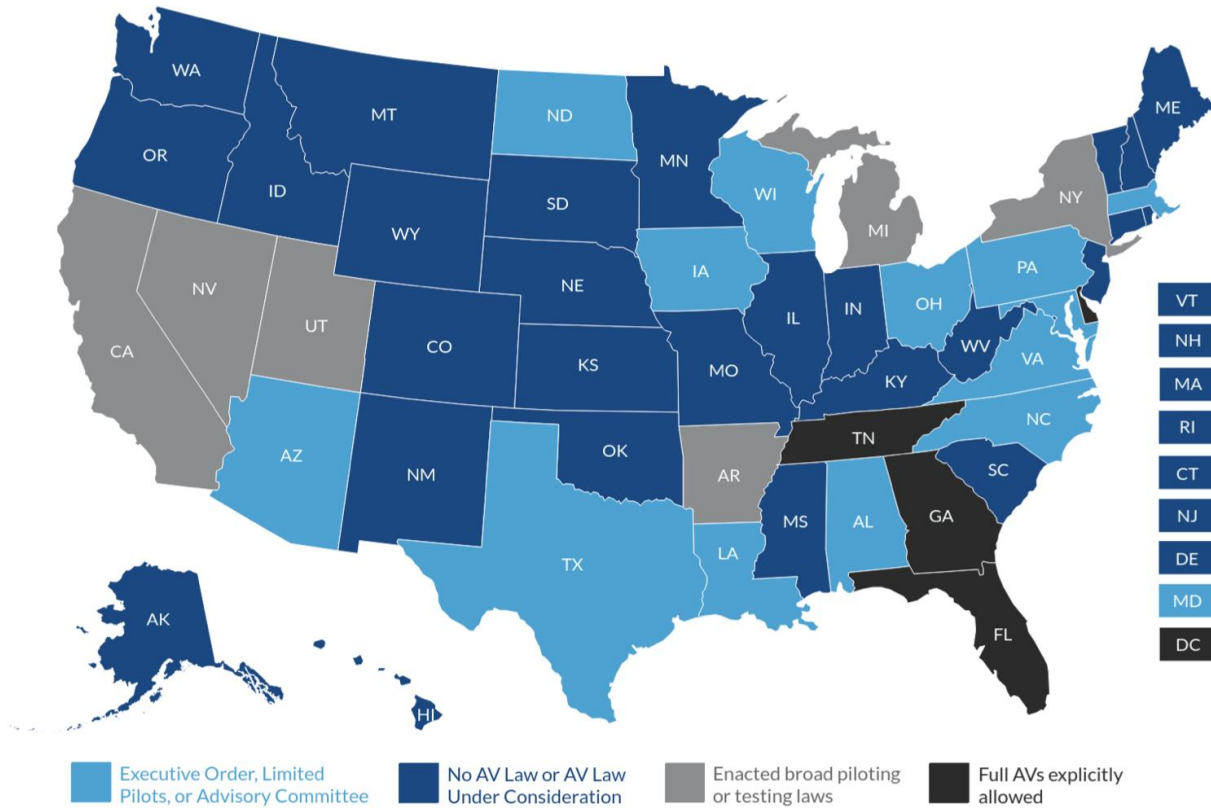
Government Role

- SELF DRIVE Act
 - Passed House
 - Preemption
 - Exemptions

Sec 3: “Nothing in this subsection may be construed to prohibit a State or a political subdivision of a State from maintaining, enforcing, prescribing, or continuing in effect any law or regulation regarding registration, licensing, driving education and training, insurance, law enforcement, crash investigations, safety and emissions inspections, congestion management of vehicles on the street within a State or political subdivision of a State, or traffic unless the law or regulation is an unreasonable restriction on the design, construction, or performance of highly automated vehicles, automated driving systems, or components of automated driving systems.”

Government Role

Figure 1: Status of state policies related to automated driving, as of May 2017



Source: National Conference of State Legislatures and individual state legislation¹⁷

Created by:
Ann Henebery / Eno Center for Transportation

Implications for Transportation

- Certification, liability and insurance
- Ethics
- Cyber security
- Privacy
- Infrastructure/funding
- Vehicle connectivity
- Research
- Workforce
- Freight
- Consumers



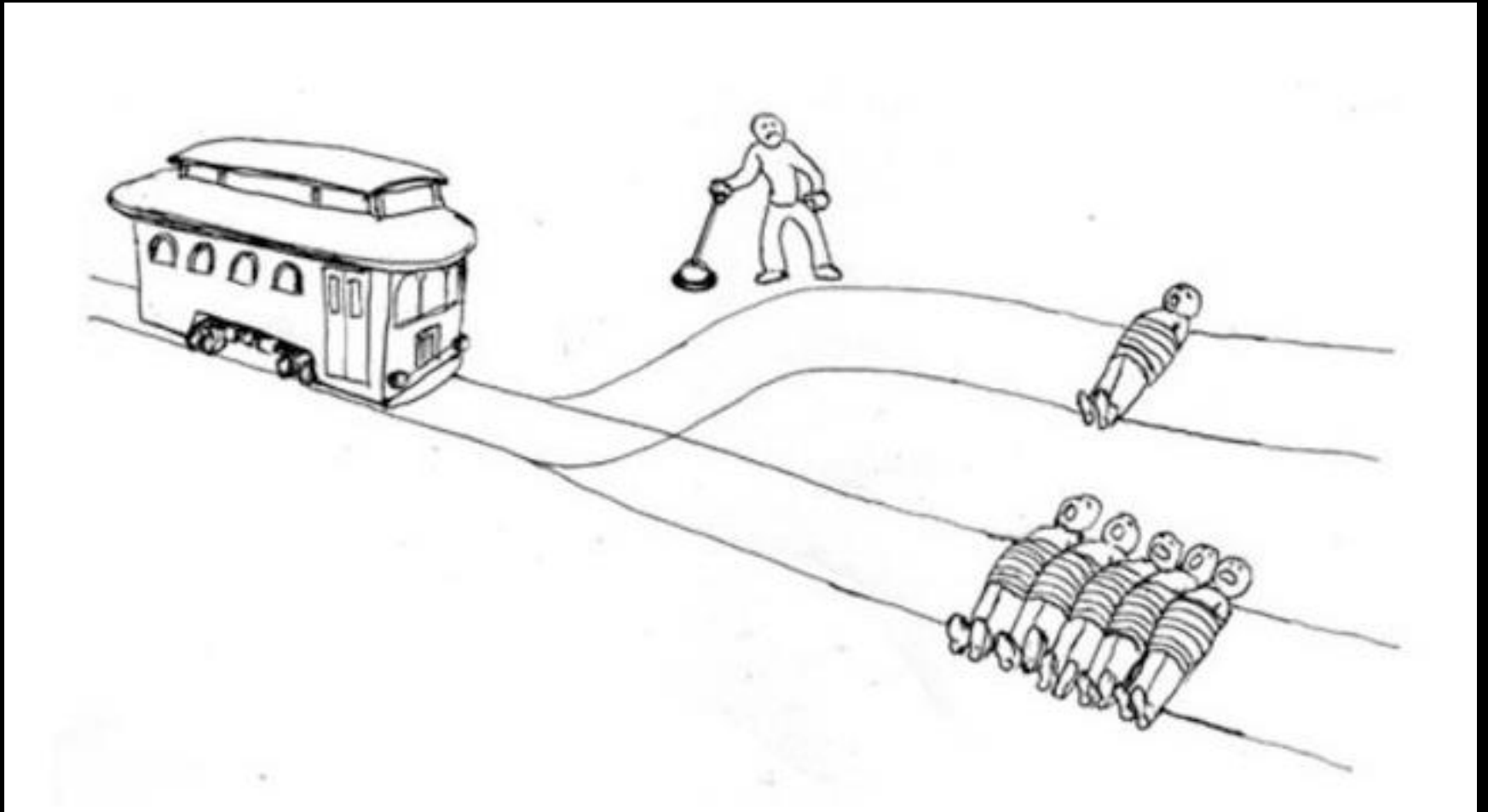
Certification, Liability and Insurance



Certification, Liability and Insurance

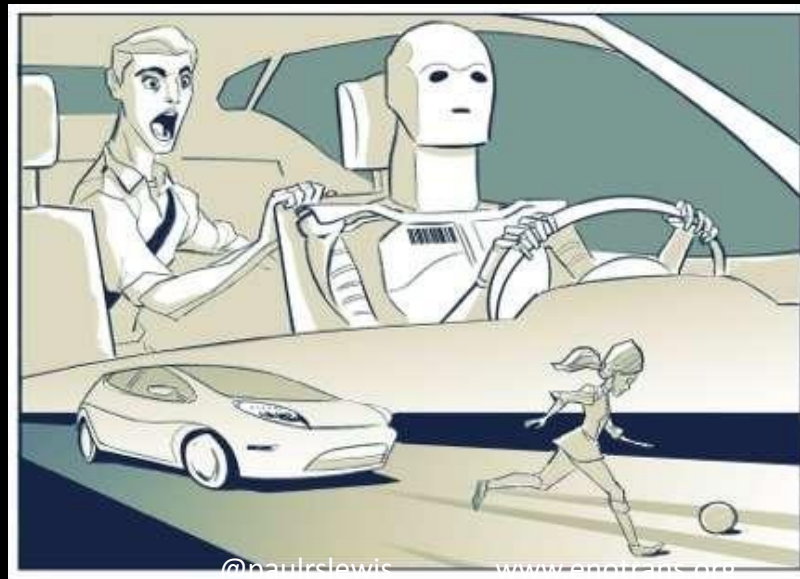
- Federal role
 - Federal Motor Vehicle Safety Standards
- State/local role
 - liability, licensing, insurance
- Harmonization between states

Ethics



Ethics

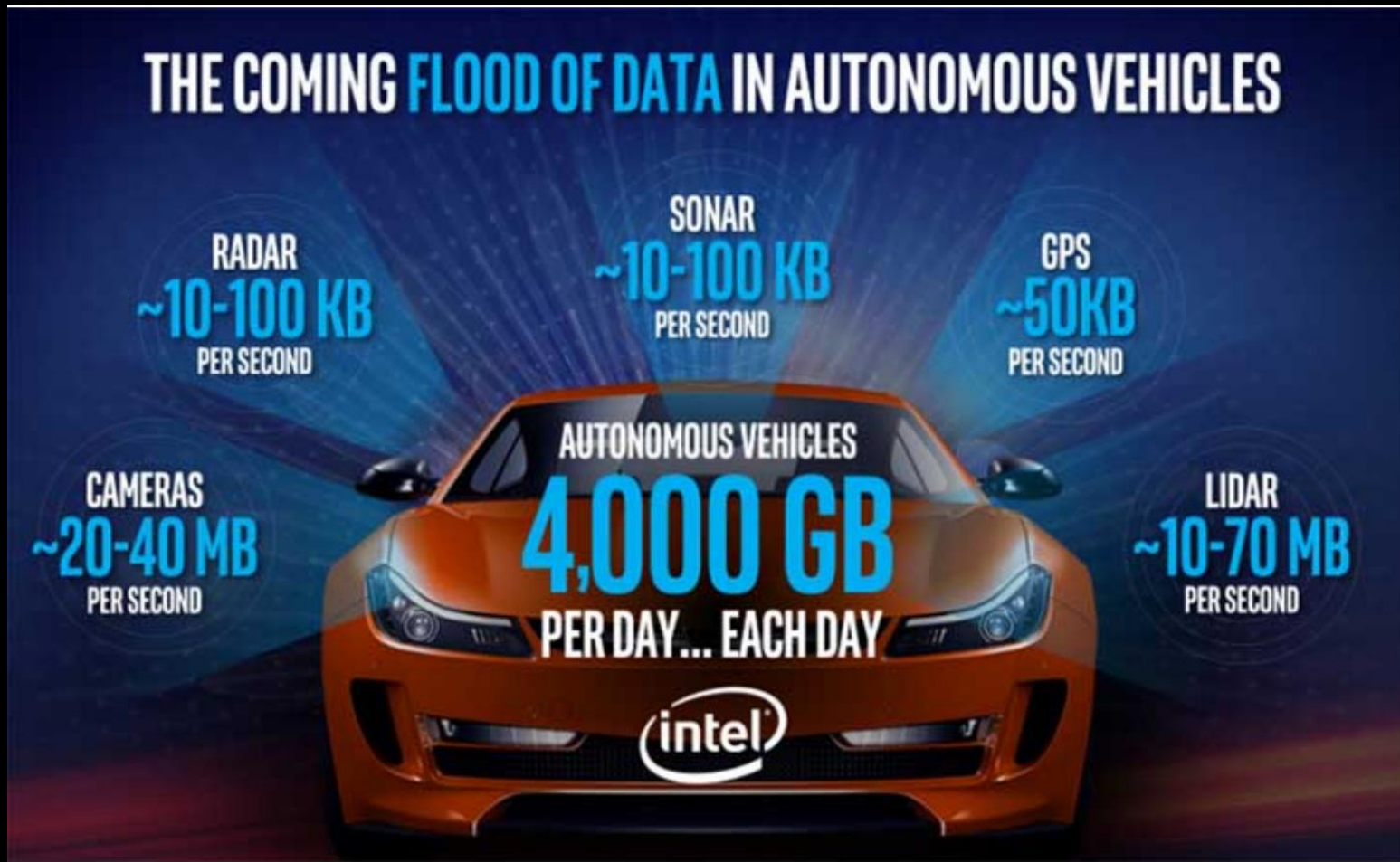
- German Ethics Commission
 - Public sector must ensure safety
 - AV developers clearly assign responsibility
 - Trolley dilemma is too complex



Cyber security



Privacy and Data



Privacy and Data

- Data owner = vehicle driver
- Regulations to protect owner privacy
- Cities enact data sharing agreement



Vehicle Connectivity



Infrastructure and Funding



Infrastructure and Funding

- ↓↓ parking, traffic violation revenues
- ↓↓ in fuel taxes
- ↑↑ demands for better infrastructure, CV tech



Needed Infrastructure

- State of good repair investments
 - Lane markings, potholes, signage, signals
- Testing of CV



Proposals for Mileage Fee

- Small per-mile fee on Level 3, 4, 5 driving
- Easy administration, significant revenue
- Oregon, Tennessee, Massachusetts



Research and Planning

- AVs in long range plans
- University programs
- Test sites



Workforce

- Truck drivers, taxi drivers, mechanics, bus operators
- “Driver” > 4 million jobs



Workforce

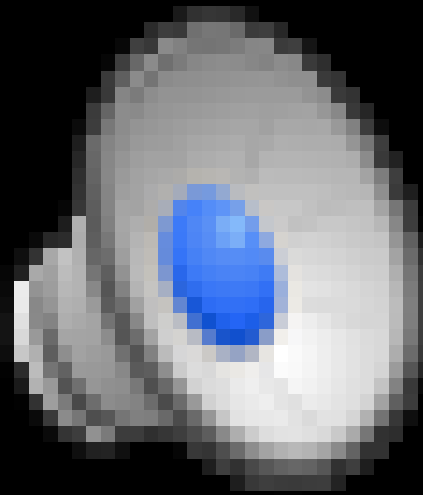
- Large scale workforce replacement unlikely because:
 - Driving is only part of the job
 - Perpetual truck driver shortage
 - Public is skeptical
 - Technology is years, if not decades, away

Freight

- Automated ships
- Automated trains
- Automated trucks



Freight – Truck Platooning



Consumer Acceptance

- Consumers are unsure about tech
- Uncomfortable with truck platooning
- Consumers are price sensitive



How to react?

- Policy recommendations for states/localities
 - Regulations
 - Infrastructure Investment
 - Workforce and research
 - Planning

AV Regulations

- Legislation or regulatory action will not necessarily attract or deter AVs
- Adhere to consistent definitions
- **Do not overdesign reporting requirements**
- Harmonize current and future tort/liability and national safety standards

AV Regulations

- **Review and update current traffic laws**
- Authorize specific pilot programs
- **Form an AV advisory committee**
- Create “statements of principles”

AV Infrastructure Investment and Funding

- Invest in improving roadway state of good repair
- **Pilot connected vehicle projects**
- **Consider per-mile AV fees**

AV Workforce and Research

- Support local research and testing grounds
- **Fund broader AV impact research**
- **Invest in workforce retraining**

AV Planning

- Incorporate scenario planning in long range plans
- Consider technology solutions to infrastructure problems
- Continue investment in critical infrastructure

AV Summary

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- **Ride Hailing**
- Technology and Transit
- Sharing Economy



Ride Hailing/TNCs



Ride Hailing/TNCs

- “Transportation Network Companies”
- Ride-hailing, ride-sourcing ride-sharing, car-sharing?
- The “modern” taxi industry



Ride Hailing Summary

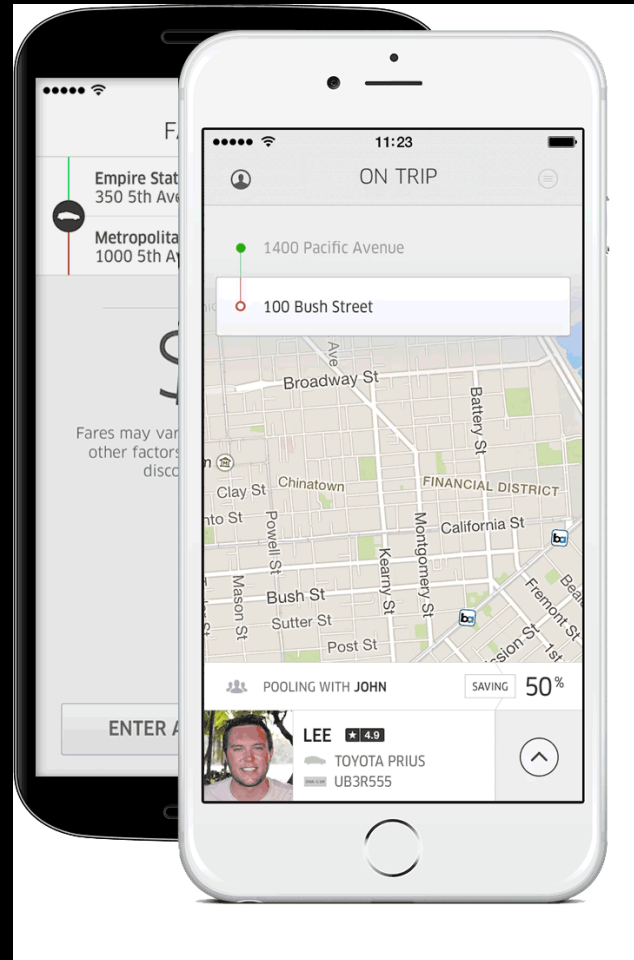
- Public demand is strong and growing
- Recent PR problems are unlikely to derail progress
- Can TNCs function profitably in suburban and rural areas?
- Role of automated technologies

Taxi-like TNCs

Attributes	Lyft	Uber
Services	TNC, premium, XL	TNC, premium, XL, Family
Driver Background Check	Yes	Yes
Two-Way Ratings	Yes	Yes
Specified Destination	No	No
TNC Driver Compensation	set fares + tip	set fares + tip
TNC Commission	25% for new drivers	20-25 %
U.S Market Share	23 %	75 %
Value	\$7.5 b	\$50 b
Quarterly Loss	\$130 m	\$645 m

Carpool TNCs

- Via
- UberPOOL
- Lyft Line
- Gett

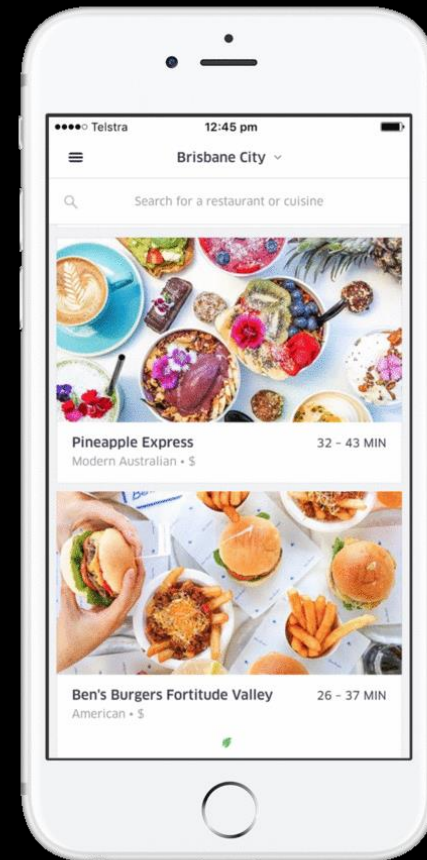


Basic Business model

- Use app to connect drivers and passengers
- Does not own the vehicles
- Surge pricing to manage supply and demand
- Emailed receipt and payment
- Constant experimentation

Platform for Opportunities

- Uber Family
- Uber WAV
- Uber Eats
- Autoplay Music
- Split fares
- Uber Freight
- ETA Status Update
- Credits at select stores



Driver's Perspective

- Independent contractors (1099 employees)
- 20 to 25 percent commission
- New addition of tips on Uber
- Mixed review on satisfaction
- Full or part time



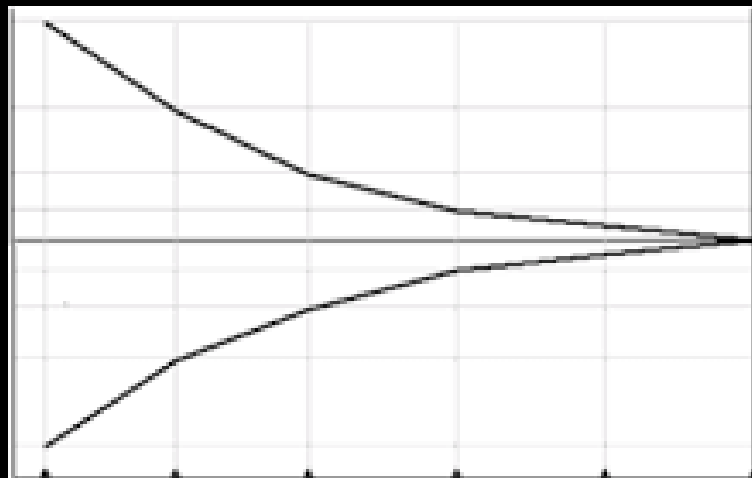
Local regulations

- Cities and states have struggled to regulate
- Traditional taxi services threatened
- Some cities permissive, some ban.



TNCs are the future Taxi Market

- Taxis are over-regulated
- TNCs are underpriced
- Eventually convergence into the new taxi industry



TNC: How to react?

- Policy recommendations for ride-hailing:
 - Re-think taxi regulations
 - Monitor drivers' rights
 - Reasonable safety and equity protections are OK

Ride Hailing Summary

- Public demand is strong and growing
- Recent PR problems are unlikely to derail progress
- Can TNCs function profitably in suburban and rural areas?
- Role of automated technologies

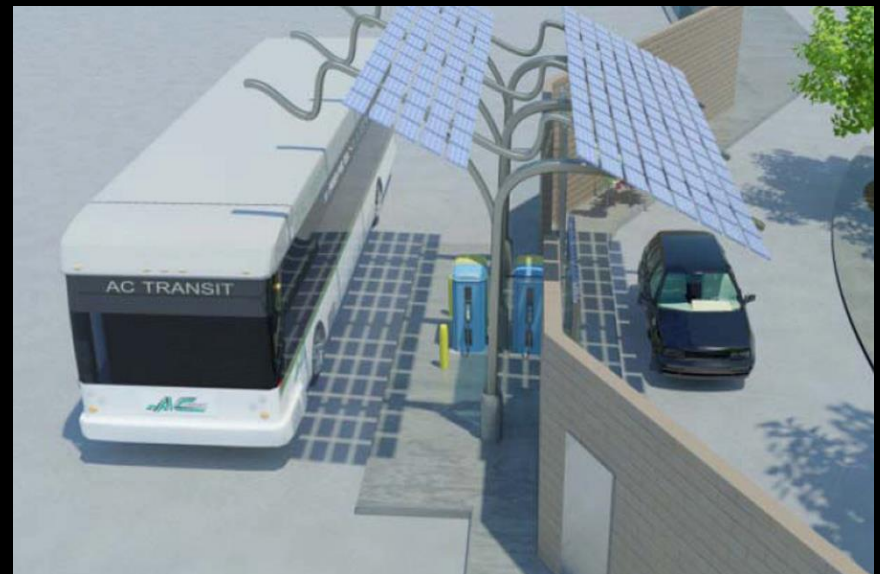
Agenda

- Automated Driving
- Ride Hailing
- **Technology and Transit**
- Sharing Economy



Technology and Transit

- Subsidized partnerships for transit services:
 - First-mile, last mile
 - Paratransit
 - Guidance applications
 - Replace bus networks?



Tech Transit Summary

- Huge opportunity for partnerships
- Problems with marketing, ridership
- Focus on goals, not technology
- More expensive than expected
- Procurement barriers
- Microtransit/TNCs cannot replace high capacity

First Mile/Last Mile “Microtransit”

- Three case studies
 - Uber/LA Metro discounted rides
 - Bridj/KCATA Microtransit pilot
 - Pinellas Sun Coast Transit subsidized Uber



Uber/LA Metro

- Opening of new Expo rail line
- Non financial transaction
- Uber provided discounts
- LA Metro provided advertising



Bridj/KCATA

- New commute routes in underserved areas
- High media visibility, low ridership
- Discontinued after 12 months



Pinellas Sun Coast Pilot

- “Direct Connect” replaced poor bus service
- Uber, Lyft, taxi, WAV options
- \$5 discount in defined area, recently expanded



Other examples

- MBTA Paratransit
- AC Transit 275 Bus line replacement
- Santa Clara VTA
- Federal Transit Administration MOD Sandbox



Other examples

- Phone apps like moovel and Google maps
- Open data for NextBus
- Employer incentive applications

Tech & Transit: How to react?

- Policy recommendations for tech and transit
 - Implement pilot projects
 - Work pilot around transportation goals
 - Ensure data sharing
 - Include technology on future bus procurements

Tech & Transit: How to react?

- Innovative Procurement



Tech Transit Summary

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Sharing Economy

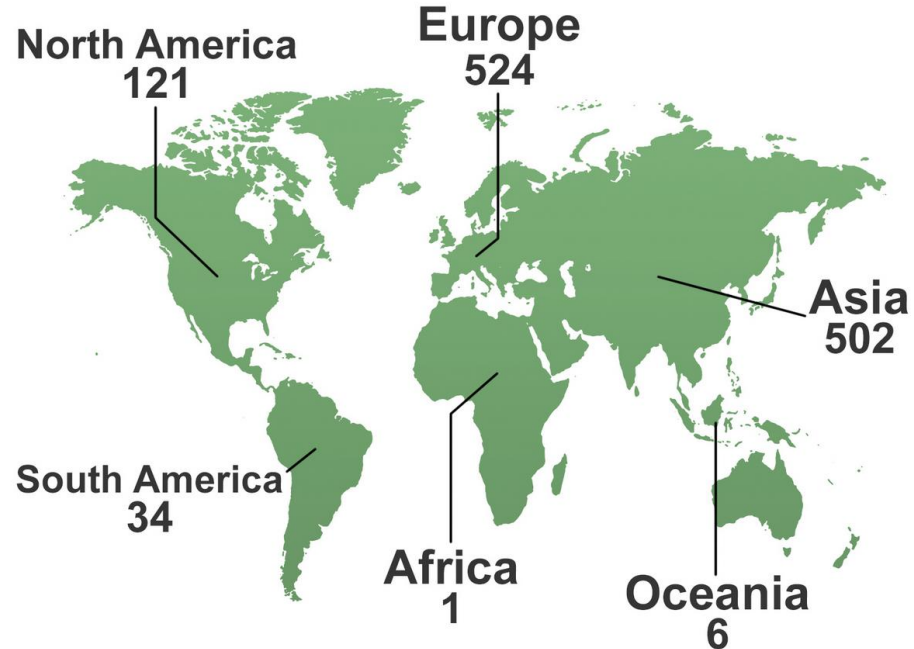


Sharing Economy Summary

- Technology has made sharing easy
- Some revitalization of downtown areas
- Often needs public partnership
- Sharing has to be easy for people to use it

Bikeshare

Public Use Bicycle Programs by Continent, year end 2016



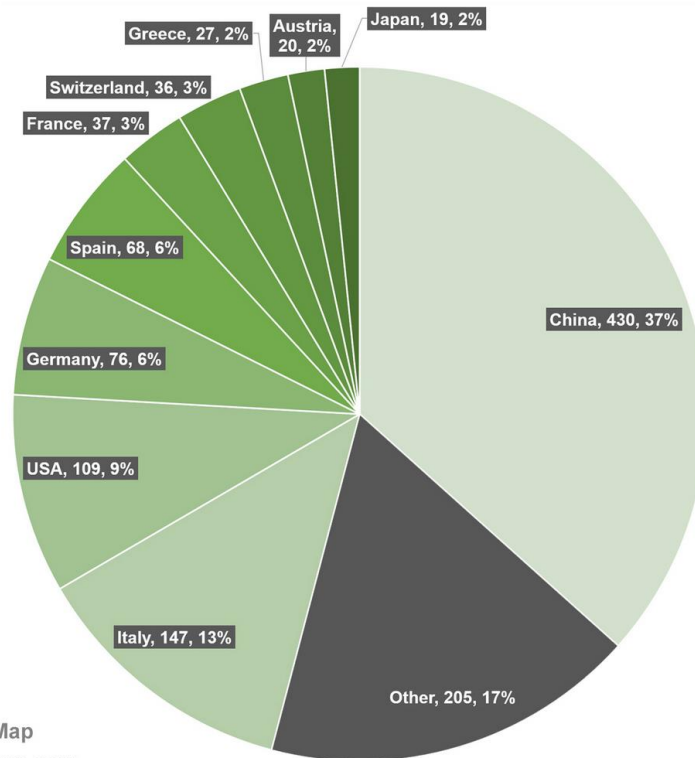
 @BikesharingMap

www.bikesharingmap.com

Data collected and maintained by Russell Meddin

Bikeshare

Public Use Bicycle Programs top ten countries, year end 2016

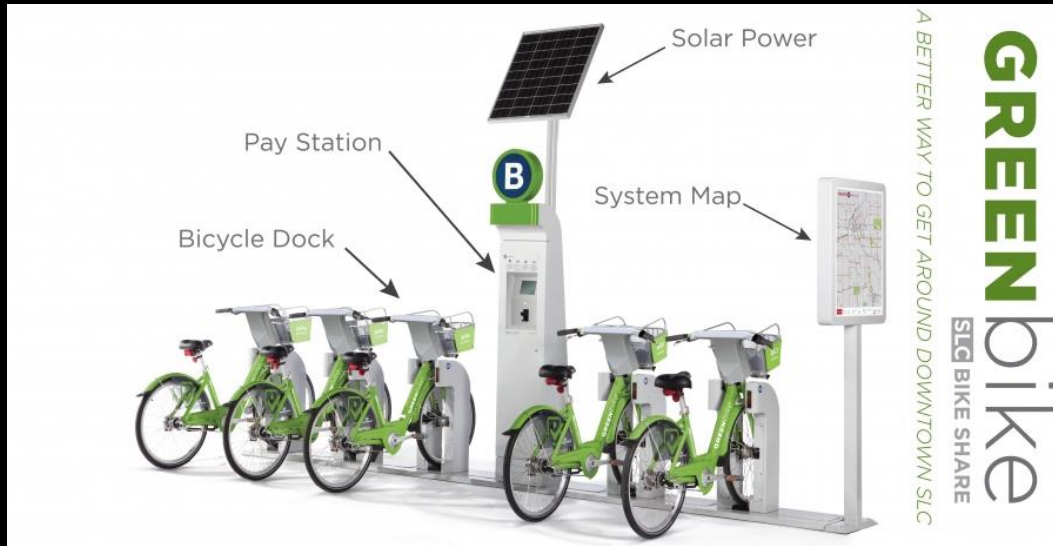


 @BikesharingMap

www.bikesharingmap.com

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Bike Sharing models



Bike share with dock

Dockless



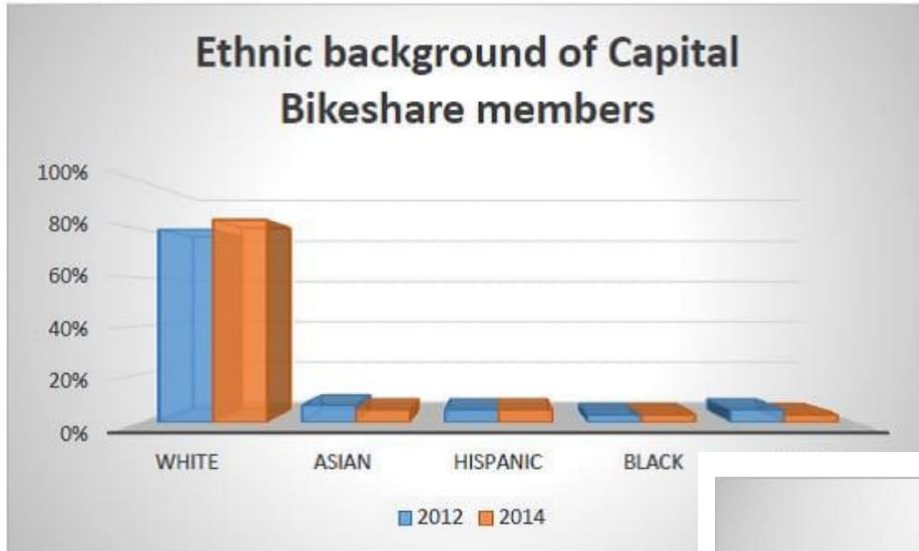
Bike Share – Governmental Role

- Requires public subsidy
- Requires public space
- Several companies provide technology

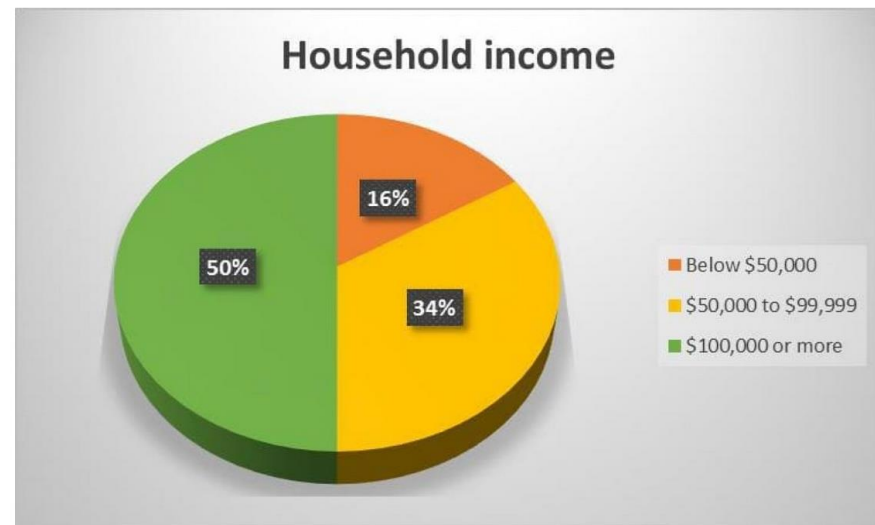
Bike Share Challenges



Bike Share Challenges



Source: Capital Bikeshare (Luz Lazo/The Washington Post)



Source: Capital Bikeshare Fifty percent of Capital Bikeshare users have household incomes of \$100,000 or more. (Luz Lazo/The Washington Post)

Car Sharing

- Three models for sharing cars:
 - Cars in designated spaces (ZipCar)
 - One way (Car2Go)
 - Peer to peer (Getaround)
- Insurance, gas, maintenance included
- Internet reservations and payment

Designated-space Car Share

- ZipCar, Maven, Hertz, Enterprise, etc.
- Choice of cars at designated spaces
- Rent by 30 minute segments
- Sometimes requires public parking spaces



One way car share

- ZipCar (in select cities), Car2Go
- Return to any point within the zone
- Charge by the minute
- Requires cooperation by city for street parking



Peer to peer car sharing

- Getaround, Turo (similar to Air BnB)
- Rent out your car to anyone on the internet
- You get paid, company takes a cut
- No city cooperation necessary



Sharing?

Sharing?

How to react?

- Test Bikeshare systems and create bike lanes to encourage use
- Partner with car sharing companies to allocate public parking spaces to shared vehicles
- Determine whether rental car taxes apply to private sharing systems
- Track use through data agreements

Sharing Economy Summary

- Technology has made sharing easy
- Some revitalization of downtown areas
- Often needs public partnership
- Sharing has to be easy for people to use it

Presentation Summary

1. Technology and transportation has limitless opportunities
2. Much of it is nascent, untested, unproven
3. Concerted effort needed to plan to achieve the optimal outcomes for communities

Questions/Discussion

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Ultramodern Transportation

- Drone delivery
- Flying cars
- Hyperloop



Ultramodern Transportation

- Drones
- Flying cars
- Hyperloop



- Streets without potholes?
- Buses that run on time?

Questions/Discussion

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