

# Disruptive Innovation in the Transportation Sector (and potentially managed lanes)

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# Acknowledgements



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# What are we talking about with:

## Disruptive Technologies



- Emerging technologies that displace established ones.
  - Sustaining technologies are well known and undergo successive improvements
  - vs.
  - Disruptive technologies may be unproven, lack refinement, relatively unknown and or even viewed as impractical.
- In the broadest of terms, they:
  - Change how people live;
  - Create new markets and business opportunities;
  - Shift existing business models.





# Current Digital Disruption

- World's largest taxi company has no cars (Uber)
- Largest accommodation provider owns no real estate (Airbnb)
- Largest phone companies own no teleco infrastructure (Skype, WeChat)
- Most popular media owner creates no content (Facebook)
- World's largest movie house owns no cinemas (Netflix)
- Largest software vendors do not write the apps (Apple and Google)

Credit: Sandy Carter, IBM

# What makes a technology disruptive?



- Simpler and cheaper to make
- Become more reliable and convenient than established technologies
- Rapidly advancing or experiencing breakthroughs
- Relatively fast penetration in the market
- Supplant existing technologies/applications
- Broad-based impact with significant economic impact

# Major Innovations from CES (Credit: Forbes Magazine)



2013

Wireless charging

“The intelligent home”

“The interface of you”

Biometric sensing and monitoring

Behavioral anticipation and response

2014

Embedded sensors

“The internet of you”

“Exponential energy”

Driverless vehicles

Immersive interfaces

2015

Automated Vehicles

“The quantified self”

3D Printing and Robotics

The Internet of Things

Augmented Reality

2016

Autonomous Vehicles

“Providers become platforms”

Invisible 5G Infrastructure

“Accidental product development”

“Moore’s Law Prevails”

# Moore's Law



- Processor speeds, or overall processing power for computers will double every two years while costs hold constant.
  - A Playstation 3 has the processing power of 660 million Univacs, the first commercial computer introduced in the 1950's
- This has the effect of continually reducing the cost associated certain aspects of technology
  - Drones
  - 3D Printing
  - Smartphones
  - HD Televisions and Cameras
  - Genome sequencing

# Implications



- Technology developments are occurring at an ever increasing pace.
  - “Partly because of disruptive innovation, the average job tenure for the CEO of a Fortune 500 company has halved from ten years in 2000 to less than five years today.” – The Economist
- Technology adoption and consumption will occur at an ever increasing rate.
- Government has traditionally been slow to respond and, when it does, it often does not act in the best interest of facilitating innovation.
  - *This is not a value judgment.*
  - *There is tension between the public interest and technology innovation*



# Why is this important to policy makers?



“The challenge for policy makers—and for citizens—is enormous. It is a good time for policy makers to review how they address technology issues and develop a systematic approach; technology stops for no one, and governments cannot afford to be passive or reactive.”

- McKinsey & Company

- Disruption is difficult to predict and can often only be assessed in hindsight.
- Disruptive innovation is likely to occur at an accelerated rate.



McKinsey Global Institute



May 2013

Disruptive technologies:  
Advances that will  
transform life, business,  
and the global economy





# 5 Focus Areas of Study



Mobile Internet



The Internet of Things



Advanced Materials



Immersive Interfaces



Automated and Connected  
Vehicles



# The Mobile Internet (MI)

- The combination of mobile computing devices (such as smartphones and tablets), high-speed wireless networks and associated applications.
- Influence of the MI on transportation systems will be driven by the continued penetration of smartphones in US households.
- MI could impact transportation agencies by:
  - Increasing demand by drivers for more data intensive services, such as real-time traffic conditions and advisories
  - Decreasing travel by personal vehicle and a decreased demand for roadway capacity.
  - Altering vehicle ownership and utilization models
  - Altering commuting patterns



# The Internet of Things (IoT)



- Sensors and data communications technologies embedded in physical objects, including roadway infrastructure and mobile devices
- Enable objects to be tracked, coordinated, or controlled across a data network or the internet.
- Potential impacts to transportation agencies:
  - IoT would improve the quality and quantity of that data used by traffic management systems
  - Transportation infrastructure, such as street lights and intersection signals, can be monitored, operated and maintained in real time
  - IoT-based technologies could serve as a basic infrastructure platform for various connected vehicle applications



# Advanced Materials



- VERY broad category
- “Nanomaterials”
  - Produced by manipulating matter at the nanoscale (less than 100 nanometers).
  - Allows for the development of materials that may have greater reactivity, unusual electrical properties, and enormous strength.
  - These include graphene and carbon nanotubes
- Could impact the transportation sector by
  - Providing strong, ultralight structural materials for use in various infrastructure development and construction activities.
  - Could significantly reduce the cost associated with maintaining transportation infrastructure due to durability



# Immersive Interfaces



- Interfaces such as a monitors (or other view screen to view information) and a keyboard or touchpad that are used to enter information
- Used in interactive virtual and augmented reality environments.
- These technologies could
  - result in new in-vehicle interfaces
  - facilitate virtual reality applications that reduce the need for certain types of trips
  - usher in a new generation of virtual reality simulation that could be used to model driver behavior



# Automated and Connected Vehicles



- Automated: vehicles can operate on roadways and navigate with little to no human intervention.
- Connected: Vehicle communicate information with each other (V2V), infrastructure (V2I) and other roadway elements (V2X)
- Currently numerous vehicle models that feature some degree of automation
- Could fundamentally change:
  - How drivers interact with the roadway environment
  - How government agencies manage transportation infrastructure.

# The Impact of Emerging Technologies on the Silicon Valley Express Lanes



- Santa Clara Valley Transportation Authority (VTA) hosted a workshop on October 9, 2015
- VTA, Texas A&M Transportation Institute, Chuck Fuhs, and Prospect Silicon Valley facilitated workshop
  - **Purpose: Examine** how the Silicon Valley Express Lanes could be impacted by **emerging technologies**
  - **19-member panel** observed 5 brief presentations on tech
  - **3 Breakout sessions** provided feedback on how VTA could better anticipate given three prompted questions
  - **1** Group Discussion



# Key questions



1. How do we “future-proof” technologies that are about to be implemented?
2. What metric(s) need to be assessed for evaluation of future systems?
3. How can throwaway of existing technologies be minimized?

# Panel Members

- 19 people representing the following entities:



J.P.Morgan



U.S. Department of Transportation  
Federal Highway Administration



McHenry Engineering



Nine other individuals observed from public agencies

# Key Findings From Panel



1. **Start visioning** to determine their beliefs, goals, objectives
2. Assess who is best suited to **handle risk** within a contract, and allocate risk accordingly
3. Understand that **technology can “leapfrog” governments** if they are insufficiently nimble or too slow to develop
4. **Collaborate** with other agencies to avoid “doing the same thing”
5. Follow the **“Grandma Rule”** to easily explain how a process or technology works to one’s grandmother
6. **Address equity concerns** because technologies are not always affordable or available
7. Realize the importance of **pilot projects** and **incrementalism**

# Other Thoughts



- Big emphasis on keeping things simple for VTA
  - VTA should make decisions that fit vision, operational consistency
- Customers becoming more impatient
  - Faster capability of mobile/connected devices to provide user feedback
  - Shorter media cycle compared to past decades
  - Users do not want to expend energy thinking
- Tech changes within next 5-10 years
  - Automated vehicle market penetration to grow
  - Integration of toll transponder within the vehicle
  - For VTA, wireless will become more practical communication medium to operate ELs compared to fiber optics
- Shorter tech cycle requires re-thinking contracts
  - More emphasis on open standards, less on contract minutiae
  - No contracts with single entities, provide data for many others to develop products (e.g. GTFS for transit)

# Thank you for your time!

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