The Internet of Things (IoT) and Automotive & Transportation Policy Principles

Background

Automotive and transportation is one of the most promising sectors for the Internet of Things (IoT). By converting vast amounts of data into meaningful and actionable knowledge, the IoT can help solve many of modern society's automotive safety, transportation efficiency, and infrastructure challenges. The IoT is enabling innovations like self-driving (autonomous) cars, "smart" fleet management, and intelligent transportation infrastructure. Notably, almost half of Americans aspire to live in a driverless city where cars, buses, and trains operate intelligently and automatically without people driving them, and over one-third expect a driverless city in ten years.[1] A policy framework that harnesses the full potential of these transformational IoT opportunities in the automotive and transportation sector is critical to US economic leadership and productivity in the 21st century.

Intel Leadership. Intel is collaborating with automakers, ecosystem suppliers, academia, and cities worldwide – utilizing the IoT to accelerate innovation toward a future of self-driving vehicles, "smart" fleet management, and intelligent transportation systems. For example, we are partnering with automakers to implement Intel In-Vehicle Solutions® that enable infotainment platforms with fundamental advanced driver assistance systems (ADAS) features like lane-keeping assistance, collision warning, and automated parking assist,[2] with future products geared for advanced driving experiences like self-driving cars.[3] We also are helping businesses use IoT technology to optimize fleet management and freight transport, using real-time data analytics to make drivers safer and more efficient while reducing fuel consumption.[4] And we are partnering with city governments to enable cutting-edge IoT transportation infrastructure solutions like intelligent traffic management (using advanced data analytics to enable integrated transportation coordination, emergency traffic response, and congestion reduction)[5] and enhanced public transportation experiences (using real-

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[1] *The Vote Is In*, Intel Corp. (Feb. 2014), http://newsroom.intel.com/community/intel_newsroom/blog/2014/02/10/the-vote-is-in-citizens-support-smart-cities-with-driverless-cars-public-service-drones-and-surroundings-that-sense-activities.

[2] ADAS Demo: http://www.intel.com/content/www/us/en/automotive/advanced-driver-assistance-systems-video.html

[3] *Intel Puts Automotive Innovation into High Gear*, Intel Corp. (May 2014), http://newsroom.intel.com/community/intel_newsroom/blog/2014/05/29/intel-puts-automotive-innovation-into-high-gear.

[4] Intelligent Freight Trucks: http://www.intel.com/content/www/us/en/intelligent-systems/tech-today/freight-truck-data-analytics-video.html Intel and Vnomics deployed IoT technology to enable 7 percent improvement in fuel economy for SAIA LTL Freight (saving 3.6 billion gallons of fuel per year), which equates to 38 million tons of CO_2 reduction annually.

[5] Intelligent Traffic Management: https://www.youtube.com/watch?v=M0ZN8El6lfY

time interactive digital signage to make multi-modal transit easier and more engaging for citizens).[6]

Policy Impact. The potential impact of IoT technology to address important societal and economic policy challenges in the automotive and transportation sector is remarkable.

- Safety and Economic Savings. Human error is the primary reason for over 90 percent of US crashes.[7] Self-driving vehicles – where the vehicle senses its environment and navigates without human input – could dramatically reduce crashes. If only 10 percent of vehicles were self-driving, US traffic deaths could decrease by 1,100 and save almost $38 billion per year; and, if 90 percent of vehicles were self-driving, traffic deaths could decrease by 21,700 and save $447 billion per year.[8] And, when 100 percent of vehicles are self-driving, the US could save $1.3 trillion per year.[9] Notably, the potential savings to the US freight transportation industry alone – one of the most compelling use cases for self-driving vehicles – is estimated at $168 billion per year.[10]

- Efficiency and Productivity. The average American commuter spends 38 hours per year stuck in traffic, which collectively causes urban Americans to travel 5.5 billion more hours and purchase an extra 2.9 billion gallons of fuel; the cost to the US economy of this wasted time and fuel is $121 billion per year.[11] Self-driving vehicles (where citizens can engage in productive activity while in transit) and more intelligent transportation infrastructure (with better traffic management) could enable a far more productive and efficient US citizenry.

- Revenue and Growth. The automotive and transportation industries will be among the first to see immediate growth from the IoT, with global IoT revenue from the transportation sector reaching $469 billion in 2017.[12] With almost nine percent of the US labor force employed in

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[6] Real-Time Interactive Transit Displays: http://www.intel.com/content/www/us/en/intelligent-systems/tech-today/transportation-digital-signage-video.html

[7] *National Motor Vehicle Crash Causation Survey*, U.S. Dept. of Transportation, at 25 (2008), http://www-nrd.nhtsa.dot.gov/pubs/811059.pdf.

[8] *Preparing a Nation for Autonomous Vehicles: Opportunities, Barriers and Policy Recommendations*, Eno Center for Transportation, at 8 (Oct. 2013), https://www.enotrans.org/wp-content/uploads/wpsc/downloadables/AV-paper.pdf.

[9] *The 'Internet of Things' Is Now Connecting the Real Economy*, Morgan Stanley (April 2014). Specifically, $488B savings from accident avoidance, $507B productivity gain from autonomous cars, $158B fuel savings, $138B productivity gain from congestion avoidance, and $11B fuel savings from congestion avoidance.

[10] *Id*. Specifically, savings from labor ($70B), fuel efficiency ($35B), productivity ($27B), and accident savings ($36B).

[11] *The American Commuter Spends 38 Hours a Year Stuck in Traffic*, The Atlantic (Feb. 2013), http://www.theatlantic.com/business/archive/2013/02/the-american-commuter-spends-38-hours-a-year-stuck-in-traffic/272905/.

[12] *Worldwide Internet of Things Spending by Vertical Market 2014–2017 Forecast*, IDC (Feb. 2014), http://www.idc.com/getdoc.jsp?containerId=prUS24671614. This is a CAGR of almost 8 percent from 2012-17.

the transportation sector[13] and the US spending roughly $160 billion annually on highway infrastructure (about one-fourth funded by the federal government)[14] – America's share of this transportation IoT revenue (and cost savings from IoT technologies) could be significant.

Policy Principles

Innovation and Competition

- Self-driving vehicle technology, "smart" fleet management, and intelligent transportation infrastructure have enormous potential to improve driving safety, mobility, energy use, and transportation efficiency – paving the way for our nation's smart cities of tomorrow.

- Innovation and market competition, rather than regulation, must drive our nation's policy framework to enable the US to lead the world in the automotive and transportation sector.

- Public policies that encourage innovation, competition, and investment are imperative for IoT technologies like self-driving vehicles to reach their full potential, realize maximum economic and safety benefits, and become widely available in a timely and globally competitive manner.

Safety Focus

- Enhanced safety is vital to the future of the America's automobile and transportation sector. Safety means (i) reducing the number and severity of crashes and (ii) protecting consumers and businesses from security breaches of the vast amount of data generated by their vehicles.

- With respect to crashes, self-driving vehicles will use sensors, lidar, GPS, and high-definition cameras to make real-time safety decisions for the vehicle (removing the risk of human error) – and thus having the potential to reduce US traffic deaths by tens of thousands per year.

- With respect to security, future vehicles will generate a tremendous amount of "data exhaust" as they seamlessly connect to consumer electronic devices and enable autonomous tasks.[15] For example, a self-driving car could generate approximately two petabytes of data per year.[16]

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[13] *National Transportation Statistics*, U.S. Dept. of Transportation, Table 3-23 (July 2013), http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_03_23.html.

[14] *Statement of Joseph Kile,* Before the U.S. Senate Cmte. on Finance, The Highway Trust Fund and Paying for Highways (May 17, 2011), http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/121xx/doc12173/05-17-highwayfunding.pdf.

[15] The Future of Intelligent Transportation: http://www.intel.com/content/www/us/en/automotive/experiencing-future-intelligent-transportation-video.html

[16] *A Self-Driving Car Will Create 1 GB of Data Per Second*, SmartData Collective (July 2013) ('Smart Data') http://smartdata collective.com/bigdatastartups/135291/self-driving-cars-will-create-2-petabytes-data-what-are-big-data-opportunitie.

- Autonomous solutions use local sensors and “intelligence” to provide a self-contained, robust source of data. By contrast, a vehicle’s wirelessly connected features exchange data with the Internet, other cars, and infrastructure – likely making this threat landscape more vulnerable.

- We must account for the distinct security challenges of autonomous and connected features, harnessing appropriate technical and policy strategies to mitigate risks and enable a safe, secure vehicle that evokes trust from drivers and passengers on US highways, while also protecting commercial and proprietary data from misuse by competitors and third parties.

- Policies that help to enable cutting-edge technology and robust data security/management will be critical to delivering the safe, secure vehicles of the future.

Open Standards

- A certain level of standardization and interoperability is vital to build a successful self-driving vehicle and intelligent transportation ecosystem. Industry-led voluntary global standards can accelerate adoption, drive competition, and enable cost-effective introduction of new technologies, while providing a clearer technology evolution path that stimulates investment.

- Industry is in the best position to lead development of technological standards and solutions to enable self-driving vehicles, “smart” fleet management, and intelligent transportation systems. Policymakers should refrain from mandating specific technologies, standards, or protocols.

- Government should encourage industry to collaborate in global open-participation efforts to develop technological best practices and standards, and it should participate in development of standards where there is a government interest and encourage the use of commercially available solutions to enable the benefits of these new technologies to become reality sooner.

Public-Private Partnerships

- *The tech industry is critical to the future of US transportation policy dialogue*. A vehicle is an increasingly complex datacenter on wheels, requiring evermore high-powered processors and Internet connectivity – with self-driving cars expected to process at 1 GB of data per second.[17]

- Viable public-private partnerships between government and the auto and tech industries must entail logical investments for both government and industry, as well as ensure scalability of automotive innovations and sustainability of transportation infrastructure in the long term.

- Using public and private resources to facilitate US research, leadership, and governance, while leveraging existing industry standards and investments, will accelerate our future toward self-driving vehicles, “smart” fleet management, and intelligent transportation infrastructure.

[17] Smart Data.