

June 1, 2016

Travis Hall  
National Telecommunications and Information Administration (NTIA)  
U.S. Department of Commerce  
1401 Constitution Avenue, NW., Room 4725  
Washington, DC 20230

Re: Notice, request for public comment.  
National Telecommunications and Information Administration (NTIA)  
[Docket No. 160331306–6306–01] RIN 0660–XC024  
*The Benefits, Challenges, and Potential Roles for the Government in Fostering the  
Advancement of the Internet of Things*

Dear Mr. Travis:

Enclosed for filing in the above referenced Public Notice are the comments of the Georgia Institute of Technology (Georgia Tech), Center for Advanced Communications Policy (CACP) and the Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC).

Should you have any questions concerning this filing, please do not hesitate to contact me via email at [helena.mitchell@cacp.gatech.edu](mailto:helena.mitchell@cacp.gatech.edu).

Respectfully submitted,

Helena Mitchell  
Principal Investigator, Wireless RERC  
Executive Director, Center for Advanced Communications Policy  
Georgia Institute of Technology  
Enclosure

**National Telecommunications and Information Administration (NTIA)  
Washington, D.C. 20554**

The National Telecommunications and Information Administration (NTIA) is initiating an inquiry regarding the Internet of Things (IoT) to review the current technological and policy landscape. The NTIA seeks broad input from all interested stakeholders—including the private industry, researchers, academia, and civil society—on the potential benefits and challenges of these technologies and what role, if any, the U.S. Government should play in this area.

COMMENTS OF  
GEORGIA INSTITUTE OF TECHNOLOGY (GEORGIA TECH), CENTER FOR ADVANCED  
COMMUNICATIONS POLICY (CACP)  
AND THE REHABILITATION ENGINEERING RESEARCH CENTER  
FOR WIRELESS TECHNOLOGIES (WIRELESS RERC)

Georgia Tech’s Center for Advanced Communications Policy (CACP) in collaboration with the Rehabilitation Engineering Research Center for Wireless Technologies<sup>1</sup> (Wireless RERC) hereby submits comments in the above-referenced Public Notice released on April 6, 2016. CACP is the home of the Wireless RERC. CACP is recognized at the state and national level as a neutral authority that monitors and assesses technical developments, identifies future options, and provides insights into related legislative and regulatory issues. CACP evaluates technological trends that can impact issues as diverse as emergency communications, vulnerable populations and social media. The Wireless RERC mission is to research, evaluate and develop innovative wireless technologies and products that meet the needs, enhance independence, and improve the quality of life and community participation of

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<sup>1</sup> The **Rehabilitation Engineering Research Center for Wireless Technologies** is sponsored by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) of the U.S. Department of Health and Human Services under **grant number 90RE5007-01-00**. The opinions contained in this website are those of the Wireless RERC and do not necessarily reflect those of the U.S. Department of Health and Human Services or NIDILRR.

people with disabilities. We believe it is essential that information and communications technologies (ICT) and services increase their levels of accessibility for people with disabilities; as access to technology can enhance inclusive and independent living. Since 2001 both CACP and the Wireless RERC have been actively involved with research and regulatory issues concerning accessible ICT and wireless communications and devices. The comments respectfully submitted below are based on subject matter expertise developed over the past 15 years. Findings from our research inform the observations made herein.

**¶1: Are the challenges and opportunities arising from IoT similar to those that governments and societies have previously addressed with existing technologies, or are they different, and if so, how?**

The growth of the Information Society is fueled by a multiplicity of elements that generate pervasive and radical changes. One of these catalytic elements is by all accounts the Internet of Things (IoT), which, quite apropos, is viewed by the International Telecommunication Union (ITU) as a “global infrastructure for the Information Society”.<sup>2</sup> At the same time, leveraging “Information and Communication Technologies” (ICTs) to allow that “all persons are able to participate as creative and productive members of their communities” is one of these positive changes that has the potential to enable people with disabilities (PWD) “to live their lives with dignity” which is increasingly recognized as an urgent priority worldwide.<sup>3</sup>

The expression, “Internet of Things,” to some extent is as much a marketing umbrella as a technical description, although is now widely used globally. It is best understood as a conceptual framework, a telling picture of a profound shift in focus describing the potential integration of anything and everything that is not a human being (i.e., the foundation of the “Internet of People”) into the communications space and the timely convergence of

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<sup>2</sup> TU-T Newslog, “New ITU standards define the Internet of Things and provide the blueprints for its development”, ITU, July 4, 2012. <http://www.itu.int/ITU-T/newslog/New+ITU+Standards+Define+The+Internet+Of+Things+And+Provide+The+Blueprints+For+Its+Development.aspx> [retrieved June 2015].

<sup>3</sup> UNESCO, “WSIS [World Summit on the Information Society] Forum 2015: Making Empowerment a Reality - Accessibility for All,” UNESCO Press Release, May 27, 2015. [http://www.unesco.org/new/en/media-services/single-view/news/wsis\\_forum\\_2015\\_making\\_empowerment\\_a\\_reality\\_accessibility\\_for\\_all/#.VXgbakZz9mM](http://www.unesco.org/new/en/media-services/single-view/news/wsis_forum_2015_making_empowerment_a_reality_accessibility_for_all/#.VXgbakZz9mM) [retrieved: June 2015].

technological and societal trends. “Things” that until now had been out of scope in telecommunications and/or computer networks because they were part of closed communications systems (e.g., door locks, fire alarms or thermostats) or not designed to be electronically linked (e.g., household appliances, meters of all sorts, or cars) are now in scope.<sup>4</sup> As such, many of the challenges related to accessibility of existing Information and Communication Technologies (ICT) apply similarly to the IoT, magnified by the social, cultural, and economic consequences of deployment and adoption of ubiquitous, always accessible flows of information, connected sensors and environmental monitoring, and data collection.

**¶7: NIST and NTIA are actively working to develop and understand many of the technical underpinnings for IoT technologies and their applications. What factors should the Department of Commerce and, more generally, the federal government consider when prioritizing their technical activities with regard to IoT and its applications, and why? Infrastructure: Infrastructure investment, innovation, and resiliency (such as across the information technology, communications, and energy sectors) will provide a foundation for the rapid growth of IoT services. 10: What role might the government play in bolstering and protecting the availability and resiliency of these infrastructures to support IoT?**

While not specifically mentioned in the public notice, emergency communications and disaster management are highly dependent on an effective, robust and resilient information infrastructure. Modern emergency communications systems are composed of a number of technologies - an Internet-of-Things, if you will - including traditional analog, digital technology and computer mediated networks. The IoT platform represents, depending on implementation, a variety of approaches to integrate and enhance the ability to communicate with vulnerable populations during emergencies and disasters.

Individuals with disabilities can be a vulnerable population during emergency situations for several reasons. This diverse demographic represents those with sensory, cognitive, physical, perceptual, and those who are elderly or aging into disabilities. For those with a

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<sup>4</sup> Mitchell, H and Louchez, L. (2016). “Trust and Accessibility In An Internet Of Things Environment.” Unpublished working paper.

disability, it can be very important to clarify the message, acquire more information, and ask questions to those that can help them best.<sup>5</sup> An overlay IoT can serve both to coordinate information flow across hybrid and legacy systems (helping to cross legacy system and geographic boundaries). In a connectivity and information distribution mode, IoT serves as a framework to communicate, alert and warn populations by providing information at the point that is readily accessible (for instance via wearable devices), and facilitate connection with bottom-up social networks.<sup>6, 7, 8</sup>

This is especially pertinent as research has shown that people, including people with disabilities often carry and use wireless devices regularly. The use of mobile devices has become an integral part of the emergency communications ecosystem, and according to a survey of user needs, 82% of 1600 respondents with disabilities stated that wireless devices were increasingly important to them while 72% stated that wireless devices were especially important during emergencies<sup>9</sup> and depended on them to receive lifesaving information and to seek help.<sup>10</sup> The IoT, then allows for use of digital technologies and to expand the capabilities, and as important, accessibility of emergency communications. The timely request for comments by the NTIA, provides the opportunity to address the inconsistencies in how emergency warnings and alerts are issued and their level of accessibility.

Although Federal agencies such as the Federal Communications and DHS IPAWS are striving to ensure all emergency notifications are accessible, there still remains among other providers inconsistencies which often results in insufficient emergency communication information to people with disabilities. Further, sometimes because of the channels chosen to deliver warnings, people with disabilities are excluded and hence refer to their personal “trust”

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<sup>5</sup> Mitchell, H and Louchez, L. (2016).

<sup>6</sup> Mitchell, H and Louchez, L. (2016).

<sup>7</sup> Bricout, J.C., & Baker, P.M.A. (2010). Leveraging online social networks for people with disabilities in emergency communications and recovery. *International Journal of Emergency Management*, 7(1), pp. 59-74.

<sup>8</sup> H. Mitchell, D. Bennett, and S. LaForce, (2011) “Planning for Accessible Emergency Communications: Mobile Technology and Social Media,” 2nd International AEGIS Conference Proceedings, Brussels.

<sup>9</sup> Muller, J et al “Accessibility of Emergency Communications to Deaf Citizens” *International Journal of Emergency Management* 7.1 (2010): 41-46

<sup>10</sup> R. Wei and L. Ven-Hwei (2006). “Staying Connected While on the Move: Cell phone use and social connectedness.” *New Media and Society* 8(1): 53-72.

network.<sup>11</sup> Policy interventions that encourage the proactive inclusion of people with disabilities in the planning stages of newer technology integrations for emergency communications could provide an important link to engagement, inclusion and usability of emergency alerts and warning.

**¶19: In what ways could IoT affect and be affected by questions of economic equity? a. In what ways could IoT potentially help disadvantaged communities or groups? Rural communities? b. In what ways might IoT create obstacles for these communities or groups? c. What effects, if any, will Internet access have on IoT, and what effects, if any, will IoT have on Internet access? d. What role, if any, should the government play in ensuring that the positive impacts of IoT reach all Americans and keep the negatives from disproportionately impacting disadvantaged communities or groups?**

The increasing momentum of wireless technologies, internet user, location-based services, telework, and home-based healthcare are just a few indicators that access to ICT has become critical for full social engagement and participation in society. As with the general U.S. population, those with disabilities are becoming significant users of the Internet<sup>12</sup> and wireless technologies, and hence by extension can be expected to be a critical population of IoT users. Internet use has social, cultural, and political opportunities for users, enabling for social inclusion and access to community, educational, commercial, professional, and governmental resources.<sup>13</sup> Yet access to these resources for people with disabilities is dependent on *accessibility*, both the accessibility of the devices needed to access the internet and the accessibility of the content posted to the internet “For a technology to be accessible, it needs to be usable in an equal or equitable manner by all users without relying on specific senses or

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<sup>11</sup> M.P. Mackrell, K.J. Twilley, W.P. Kirk, L.Q. Lu, J.L. Underhill, and L.E. Barnes. “Discovering Anomalous Patters in Network Traffic Data during Crisis Events.” Proceedings of the 2013 IEEE Systems and Information Engineering Design Symposium, University of Virginia, Charlottesville, VA. April 26, 2013.

<sup>12</sup> Pew Research Center (2010). Americans living with disability and their technology profile. [<http://www.pewinternet.org/2011/01/21/americans-living-with-disability-and-their-technology-profile/>]

<sup>13</sup> Jaeger, P. (2006). “Assessing Section 508 compliance on federal e-government Web sites: A multi-method, user-centered evaluation of accessibility for persons with disabilities.” *Government Information Quarterly* 23: 169-190.

abilities, and it needs to be compatible with assistive technologies that users may rely on [...] and many other devices that persons with disabilities may employ.”<sup>14</sup>

The importance of access in legacy communications technologies is already recognized, and hence proposed policy development has precedents to look to. The Americans with Disabilities Act of 1990 (as amended)<sup>15</sup>; rulemakings by the Federal Communications Commission (FCC) on emergency alerts systems<sup>16</sup> and the advanced communications provisions<sup>17</sup> all address ensuring critical and equal access to information and communication technologies. Further, the Twenty-First Century Video and Communications Accessibility Act of 2010 [PL 111-260] marks a major step forward in codifying rights to technology access for Americans with disabilities.

The ability to connect with anyone anytime is among the most important reasons people with disabilities use technologies and is drawn toward a world of IoT. “Today’s lifelines are advanced technologies, relied upon to conduct daily activities inside and outside the home enabling people to interact anytime from anywhere”<sup>18</sup>. IoT promises to broaden the availability of, as well as the range of, life enhancing services; and moving past active use, the range of passive sensors, environmental monitors, and alerting devices that make independent living of people with disabilities, and the aging, exponentially more feasible.

Among current and projected uses of IoT, accessible systems include monitoring systems in a nursing home,<sup>19</sup> audio publications over various platforms for those with visual impairments, growth in telepresence robotic systems<sup>20</sup> a plethora of current and innovative

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<sup>14</sup> Jaeger, P. [2002]. *Disability and the Internet: Confronting a Digital Divide*. Boulder, Colorado: Lynn Rienner Publishers.

<sup>15</sup> The Americans with Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 327, 1990 (codified at 47 U.S.C. §225) (“ADA Title IV”).

<sup>16</sup> FCC. (2004). *In the Matter of Review of the Emergency Alert System* [04-296] Federal Communications Commission: Washington D.C

<sup>17</sup> FCC. (2014). *Tentative Findings about the Accessibility of Communications Technologies for the 2014 Biennial Report Under the Twenty-first Century Communications and Video Accessibility Act* [10-213]. Federal Communications Commission: Washington D.C., August 28, 2014.

<sup>18</sup> H. Mitchell, “Great Expectations: Keeping People with Disabilities Connected in a Wireless Future,” The End of the Phone System Workshop. Wharton Business School, University of Pennsylvania. May 17, 2012.

<sup>19</sup> J. Huang, (2013). “Research on Application of Internet of Things in Nursing Home.” *AMM Applied Mechanics and Materials* 303-306: 2153-156. Web. <http://www.scientific.net/AMM.303-306.2153>

<sup>20</sup> R. Leeb, L. Tonin, M. Rohm, L. Desideri, T. Carlson, and J.D. R. Millan, “Towards Independence: A BCI Telepresence Robot for People With Severe Motor Disabilities.” *IEEE Xplore*. N.p., June 2015. Web. <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&number=7109829>

navigation systems,<sup>21</sup> and accessible prototypes developed to provide applications to/or integrate wireless emergency alerts into travel sized devices for people with disabilities.<sup>22</sup>

As new Federal U.S. and global regulations and industry standards are negotiated, internet access via mobile devices, cost effective delivery of broadband services to people with disabilities, especially all people living in rural areas, may well become the primary platform for information and communications IoT among people with and without disabilities.<sup>23</sup> It is extremely important that 1) proactive Federal policy be developed and 2) regulatory bodies provide broad-based accessibility provisions that can deliver a flexible applicable architecture as IoT evolves, with the ability to guide industry and engage appropriate stakeholders in developing accessible products and services that also promote usability of the same. As the NTIA develops the proposed green paper, we urge that these issues of accessibility and hence inclusivity of the IoT be a key objective.

The importance of IoT accessibility along many dimensions – technology, service, design, information access, and economics – was summed up in a recent article: “While the Internet of Things offers great benefits to all, people with disabilities stand to benefit considerably from connected technologies. The technology used to build smarter cities and smarter homes can help create a more accessible environment for people with disabilities and offer them the opportunity to live more independently.”<sup>24</sup>

In closing, we commend the NTIA’s efforts to encourage growth of the digital (and we would add, *accessible*) economy and ensure that the Internet remains an open platform for innovation, and look forward to the subsequent proposed “green paper” identifying key issues impacting deployment of these technologies, highlights potential benefits and challenges, and identifies possible roles for the federal government in fostering the advancement of IoT technologies in partnership with the private sector.

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<sup>21</sup> "A Multiple Sensor-based Shoe-mounted User Interface Designed for Navigation Systems for the Visually Impaired." *IEEE Xplore*. N.p., n.d. Web. <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5452688>

<sup>22</sup> D. Bennett. (2015). "Findings from People with Disabilities and Emergency Managers on the Use of Websites and Social Media to Deliver Accessible Emergency Alerts." National Hurricane Conference, Austin, TX, March 2015.

<sup>23</sup> Gould, M. & Studer, E. (2010). *Convention on the Rights of Persons with Disabilities (CRPD) 2010 ICT Accessibility Progress Report*. G3ict – the Global Initiative for Inclusive Information and Communication Technologies, 2010 [http://g3ict.org/resource\\_center/CRPD\\_Progress\\_Report\\_On\\_ICT\\_Accessibility\\_2010](http://g3ict.org/resource_center/CRPD_Progress_Report_On_ICT_Accessibility_2010)

<sup>24</sup> J. New, "The Internet of Things Means a More Accessible World", <http://www.datainnovation.org/2015/05/the-internet-of-things-means-a-more-accessible-world/> [retrieved: May 2015]



To this end, the CACP and the Wireless RERC, wish to emphasize the importance of including accessibility for people with disabilities to the greatest extent possible as part of the design and development of the Internet of Things (IoT) and associated devices and services and policy.<sup>25</sup> To achieve these objectives, we urge that people with disabilities be consulted 1) throughout the design and development phases of the IoT, and (b) the accessibility implications of future technologies should become a high-level consideration when planning Federal level technology development strategies and policy.

Respectfully submitted,

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<sup>25</sup> Baker, P.M.A.; Gandy, M. & Zeagler, C. (2015). Innovation and Wearable Computing: A Proposed Framework for Collaborative Policy Design. *IEEE Internet Computing*, 19(5) (September-October).