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## **Keynote Speech**

**“Imagineering” an Internet of Anything**

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[http://csrc.nist.gov/staff/rolodex/voas\\_jeffrey.html](http://csrc.nist.gov/staff/rolodex/voas_jeffrey.html)

### **Abstract**

From Wikipedia, the term “Imagineering, a portmanteau, was popularized in the 1940s by Alcoa to describe its blending of imagination and engineering, and adopted by Walt Disney a decade later to describe the skill set embodied by the employees of WDI, known as Imagineers.” In this talk, the idea of applying, Imagineering, to the Internet of Things, is presented.

Twenty five years after Sir Tim Berners-Lee invented the World Wide Web, our world is moving rapidly towards radical, ubiquitous, super-connectivity through the Internet of Anything (IoA). We consider the IoA to subsume a chain of phenomena including the Industrial Internet (II), the Internet of Everything (IoE), the Internet of Things (IoT), cyber physical systems (CPS), and cyber biological systems (CBS).

Cyber, physical, and biological worlds are becoming increasingly interlinked through CPS and CBS. The IoT era, which we are currently experiencing, and which has been described as “scary as hell” [1] is characterized by millions of new devices regularly being connected to the Internet. Vast amounts of data are being generated by the numerous connected through the IoT devices, but also through crowd-sourcing the social networks on the Internet of Humans (IoH) and directly by humans. Innovations, driven by the advances in mobility, cloud computing, and big data analytics further increase the number and kinds of connections, as well as the opportunity people and machines to drive an unprecedented value from these connections. The “things” are about to add capabilities like context awareness, increased processing power, and energy independence, and as more people and new types of information are connected in a more relevant and valuable way, we will quickly enter the era of the IoE. Further the Industrial Internet (II) has been recently defined as “the convergence of machine and intelligent data”. On the next, more abstract level, comes the IoA, where the imaginary is not only about connecting new categories of things at exponential rates, but about envisioning a common software “ecosystem” capable of accommodating any and all sensor inputs, “system” states, operating conditions and data contexts — an overarching “Internet Operating System”. The piece parts for such an architecture

are already emerging; taking the form of flash memory, persistent magnetic disk, NoSql, Sync, mobile and wearable computing, Hadoop, object storage, Virtual computing, cloud computing, Software Defined Networks (SDN), and converged infrastructure abstractions.

While this short talk cannot cover all of this space, Voas will discuss a new Lab of Things (LoT) at NIST that he is building to better understand the cores issues of massive scalability, heterogeneity, wireless (security and privacy), and geo-location and modifiable global clock concerns related to individual things. This will be the software/cyber/IT/identity-management “trust” problem of this century.

[1] [http://www.cio.com/article/750242/Cybersecurity\\_Expert\\_and\\_CIO\\_Internet\\_of\\_Things\\_is\\_Scary\\_as\\_Hell\\_?source=CIONLE\\_nlt\\_mobile\\_2014-03-26](http://www.cio.com/article/750242/Cybersecurity_Expert_and_CIO_Internet_of_Things_is_Scary_as_Hell_?source=CIONLE_nlt_mobile_2014-03-26)

### **About the speaker**

**Dr. Jeffrey Voas** is a Computer Scientist at the US National Institute of Standards and Technology (NIST). His current research interests include vetting mobile app software, how apps depend on clouds, software certification ethics, and Internet of Things (IoT). Dr. Voas has worked for small private companies, defense contractors, and government agencies.

Dr. Voas has served as the IEEE Reliability Society President (2003-2005 and 2009-2010), Vice-President of the IEEE Technology Management Council for Operations (2013-2014), and as IEEE Director (2011-2012). He has co-authored two John Wiley books: *Software Assessment: Reliability, Safety, and Testability* (1995) and *Software Fault Injection: Inoculating Software Against Errors* (1998). He on the editorial board of IEEE Computer Magazine as well as the Editorial Advisory Board of IEEE Spectrum Magazine. Dr. Voas also serves on IEEE’s Industry Advisory Board for the Future Directions Committee, and on IEEE’s Fellow Committee. Dr. Voas received his B.S. in Computer Engineering from Tulane University (1985), and his M.S. and Ph.D. in Computer Science from the College of William and Mary (1986 and 1990, respectively). He is a Fellow of the IEEE, American Association for the Advancement of Science (AAAS), and Institution for Engineering and Technology (IET). In 2014, Voas received a Gold Medal from the US Secretary of Commerce, the highest award given to any employee in Commerce.