



Fourth Industrial Revolution: Internet of Things, Real-Time Decision Making, Artificial Intelligence

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Abstract. The post-COVID world economy continues to underscore the prominence of the disruptive and interrelated Big Data technologies of Internet of Things (IoT), Real-Time Decision-Making (RTDM), and Artificial Intelligence (AI), which, together, underpin the Fourth Industrial Revolution. IoT is generally considered to be a range of devices or systems, each with an Internet Protocol address. In earlier papers, the author defined such devices and systems as servgoods, or items that can be thought of as physical products enveloped by services-oriented layers that can render each product or good to be smarter, adaptable and/or customizable for a specific purpose. Indeed, the transmission of both information and power with greater bandwidth (i.e., data transfer capacity) and minimal latency (i.e., data delay) are critical to RTDM; it is based on an integrated system of computers that must perform critical decision-oriented functions in near real-time or within a time frame of as short as 67 nanoseconds, each encompassing the steps of sensing or data fusion, processing or data analysis, reacting or decision-making, and learning or feedback processing. Clearly, an IoT servgood – or, say, an autonomous vehicle – must be constantly sensing, processing, reacting, and learning. At present, the most critical Big Data component is AI, an evolving set of technologies that enable computers to simulate elements of human thinking, understanding, learning and decision-making. Central to AI is machine learning, an approach that is loosely modeled on the way layers of neurons and synapses in the brain change as they assimilate new input; sometimes, such deep learning may even result in a trained machine that can outperform their human counterparts. AI-based servgoods include virtual assistants that can understand natural language and appropriately respond; robots that can automatically carry out a complex series of tasks; medical devices that can assist with diagnostic and/or therapeutic decisions; and platforms that can allow users to employ pre-built decision-making algorithms. Finally, in a connected IoT, RTDM and AI world, there are ample opportunities for breaches of privacy and security; not only are the resultant servgoods vulnerable to being hacked but so are their various connected devices. Clearly, such breaches of security must be appropriately addressed by technical standards and government regulations.

Bio. Dr. Tien is currently Dean Emeritus of the College of Engineering at the University of Miami, Coral Gables, Florida. He received the BEE from Rensselaer Polytechnic Institute (RPI) and the SM, EE and PhD from the Massachusetts Institute of Technology (MIT). He has held leadership positions at Bell Telephone Laboratories, at the Rand Corporation, and at Structured Decisions Corporation (which he co-founded in 1974). He joined the Department of Electrical, Computer and Systems Engineering at Rensselaer in 1977, became Acting Chair of the department, joined a unique interdisciplinary Department of Decision Sciences and Engineering Systems as its founding Chair, and twice served as the Acting Dean of Engineering at RPI. Dr. Tien's areas of research interest include the development and application of decision-making techniques. He has published extensively and has been honored with both teaching and research awards, including being elected a Fellow in IEEE, INFORMS and AAAS and being a recipient of the IEEE Joseph G. Wohl Outstanding Career Award, the IEEE Major Educational Innovation Award, the IEEE Norbert Wiener Award, and the IBM Faculty Award. In 2001, Dr. Tien was elected to the prestigious U. S. National Academy of Engineering.