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January 20, 2014

2014: An Internet of Things Odyssey

By Chris Ford

It almost defies belief that Stanley Kubrick's groundbreaking 1968 film, "2001: A Space Odyssey" will be more than 45 years old in 2014. Some of the more esoteric, non-verbal scenes in the movie are head-scratchers for many, but 2001's way-ahead-of-its-time premise that artificial intelligence is a living, evolutionary being on a par with humanity is still an astounding concept. This brings to mind an emerging term, called "The Internet of Things," or IoT, which has been percolating since the late 90s and is now starting to receive some serious attention. An Internet search will yield a host of explanations regarding IoT, but I like Techopedia's definition best:

"The Internet of Things (IoT) is a computing concept that describes a future where everyday physical objects will be connected to the Internet and be able to identify themselves to other devices. The term is closely identified with RFID as the method of communication, although it also may include other sensor technologies, wireless technologies or QR codes. Each definition shares the idea that the first version of the Internet was about data created by people, while the next version is about data created by things."

The Internet of Things was originally attributed to British technology pioneer Kevin Ashton in 1999. Techopedia's website quotes Ashton in an article from the RFID Journal, describing his own view of the IoT's potential:

"If we had computers that knew everything there was to know about things - using data they gathered without any help from us - we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best."

Who could possibly have conceived this world of ambient intelligence, in which objects and devices are capable of interconnection, intercommunication and synchronicity — all without the need for human interference? The IoT is still an evolutionary work in progress, but in the not-too-distant future we shall all be incorporating the IoT into our daily lives as second nature.

Musings on Using The Internet of Things in the Near Future

Government and the private sector are currently taking advantage of the IoT in the form of relatable computers, smart phones, tablets, sensors, the cloud, QR codes, and other RFID technology for any number of business processes. It's a safe bet, however, that today's creative minds are coming up with genius ideas that will start drawing even more business value from the IoT in the next few years and beyond. If you're wondering how the IoT might be working in the future, here are a couple of (not-quite-so-plausible-just-yet) potential scenarios:

Example 1 – Potholes

Potholes are the bane of every driver's existence. Let's say you're driving down the road and you hit a pothole. Your car (which is interconnected via cell, GPS, or some other device to be rolled out soon) has a sensor that detected the location of the pothole and sent a notification to the responsible municipality, letting it know about the problem. No human received the alert — it simply went to the municipality's servers that manage road maintenance. Those servers issued a service call to a robot. What kind of robot? A pothole-fixing robot. This non-intrusive robot roams at its own pace to the location of the pothole and goes about fixing it with the newly developed polymers to provide a better road surface than the original asphalt it is replacing. What

if the robot gets hit by a car during the process? No worries! It is a nearly indestructible robot that just picks itself up. Once the repair is completed, said robot signals the home servers that the pothole is fixed and then heads to its next fix location.

Example 2 – The Game Ends

It's 2014 and sporting events, involving humans, are still arguably among the most popular forms of entertainment throughout the world. I think we can all agree that trying to leave a stadium after a big game is generally a nightmare. For instance, when a football game in a large-scale, 60,000-seat stadium ends, traffic is terrible. Conventional means of dealing with the problem could include police officers running signals and directing traffic to the best of their ability. However, shouldn't the solution to this problem be sensor-based, optimized with computers and self-learning? In this example, the technology is already there, making it possible to solve this problem without any necessary human interaction in order to provide optimal traffic handling.

Seriously, How to Apply The Internet of Things to Make the World a Better Place

Rather than simply presenting a picture of "Here is what the IoT will be," it's probably more productive to discuss the IoT in terms of how we can make our world a better place through IoT, and what those keys will be. They include data integration, predictive analytics and other algorithms, real-time connectedness and big data analysis. In addition to these key components, it will be absolutely essential to foster a great deal of cooperation between many different entities for such a vision to work.

Let's consider this last point first. In order for the pothole example to become reality, we would need automobiles connected, municipalities connected, the appropriate sensors placed on cars, more advances in robotics and polymers, large capital investment, labor union negotiations for the reduction of road workers . . . and the list goes on. However, once this vision has been realized, then we'll know that IoT has grown into its full maturity.

Let's assume the responsible parties have all come together and agreed to give the potholes scenario a shot, taking into account all the details this project entails. First, it will need the correct pieces of information flowing to the correct machine-based stakeholders. That information flow will not be a trivial problem to solve, even if the parties are willing. For instance, where should the information flow to if the pothole is encountered seven inches outside city limits? Or in the middle of nowhere? Or in someone's private parking lot or driveway? Or from a bump in the road that turns out not to be a pothole? It gets complicated, but it is apparent where this sort of thing leads. The information flow could first come from a car, moving to an inspection robot, then to a fixer robot, then to another inspection robot verifying the fix was completed satisfactorily, and on and on.

The problem is solvable, but the bigger question might be who will step up to solve it? Whoever accepts these challenges will also be taking on a significant amount of risk. What politician will put his or her neck on the line? What product manager will say yes to adding more expensive sensors to the car? What R&D groups will say yes to producing better polymers, fix techniques, robotics, etc. Taking a second look at the football game example, we already have operations centers in municipalities that are filled with human analysts monitoring traffic. We have civil engineers who try to optimize traffic patterns and signals, and we have experienced traffic police helping the flow of traffic. How can we better these more human-centered approaches?

This is where better information resources come into play, with big data and data integration as the ultimate keys to the solution. Not only will your traffic optimization algorithms benefit from real-time reaction to which routes have opened up, these equations will also learn over time which routes must open up first. Those routes would then be pushed more heavily from the beginning. Another consideration will involve how weather affects traffic patterns. Should the route optimization work differently in sun, rain, and snow? Also, where do bottlenecks traditionally originate from other arenas around the country? Do these approach Interstate highways or specific after-game popular bars, restaurants or other attractions? What if basketball traffic starts to flow into the area just as football traffic starts to exit the area? While some anecdotal reasoning can provide traffic cops with rule-of-thumb responses to certain traffic behaviors, sensors loaded throughout the area will give the most accurate information toward determining how best to alleviate traffic.

For that, we look to future innovators to create new IoT methods, techniques, installations and sensors, among other technologies. A mix of real-time analytics as well as pattern recognition and trending over time will be a part of the solution. Predictive analytics will learn and self-correct, improving as more data accumulates over time. In the sports example, genetic algorithms will help alleviate traffic much more efficiently than humans, through the integration of varied data that will include but not be limited to weather, local events, average car accidents and car breakdown

prediction information. The most intriguing aspect in the equation is the system's ability to continually learn and improve its optimization as it gains more information, without human intervention.

We are barely starting to scratch the surface of the Internet of Things — what it really means, and how we can best use it to benefit us all. It's much more than simply putting an RFID on everything under the sun. It is also important to recognize the huge IoT opportunities that are available to all imaginative stakeholders who see a problem, find a way to fix it, and build on their success by adapting solutions to other challenges. And one strange coincidence of minor note: Kevin Ashton was born in 1968. I hope his middle name isn't HAL.

Chris Ford is a Principal and founding member of CBIG Consulting, a professional services firm focused on BI, DW, and Big Data analytics solutions for many of the world's leading organizations. Ford is a recognized thought leader in the Big Data analytics community, and has more than 20 years of experience in BI and DW strategy, design, and development with nearly all best-in-breed technologies. Ford is a graduate of the University of Notre Dame.