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Where The Wild Things Are, In The Internet Of Things

Summary

- The Internet of Things is expected to include a large number of Internet-connected sensors, every-day objects and appliances.
- One challenge not yet discussed is how connected "things" can track their own locations. Many uses for the Internet of Things requires knowing where the "things" are.
- Several technologies are currently in development that will enable the Internet of Things to keep track of where the things are.

The upcoming Internet of Things, almost everyone agrees, will include a lot of Things. Various R&D projects are working on various types of Things, but all agree, there will be a lot of Things.

For some companies, such as Qualcomm (QCOM), Cisco (CSCO), and others, the Things include common appliances and objects around the home, such as coffee makers, teddy bears, light bulbs and wine coolers. For other companies, such as IBM (IBM), Intel (INTC), Google (GOOG), Cisco and others, the Things include huge numbers of sensors, measuring cars on every road, pedestrians on sidewalks, and locations of busses and trains. Around the house, similar sensors can detect when doors are opened, when water leaks on the floor, when kids are walking around at night, and when appliances stop working.

These two visions of the Internet of Things, the first involving connected every-day objects and appliances and the second involving connected networks of sensors, are the visions underlying R&D by dozens of companies researching the Internet of Things. Many predict that there will be over 50 Billion connected Things by 2020.

As the Internet of Things unfolds, one problem that arises is keeping track of locations of the Things. When 50 Billion Things are out in the wild, how do we know where the Things are?

Consider a typical “smart city” project deploying thousands of sensors around a city to track the numbers of cars on the roads, the speeds at which they’re moving, and so on. Projects of this sort

often track traffic jams, parking space availability, traffic light effectiveness, situations of danger or crime, and more.

Part of deploying a project of this sort is keeping track of where all the sensors are and utilizing these locations to analyze sensor data and manage the sensor networks. In other words, thousands of networks around a city are useless if you don't know exactly where each sensor is located. Currently this is left to project managers, since most sensors themselves do not have the means of determining their locations. But if sensor locations get mixed up, all the data analysis is going to be wrong. And if locations are unknown, project workers can't even get to the sensors to replace or fix them.

Consider also a site that wants to deploy "smart lighting," in which lights are controlled by wireless connectivity from a central controller. One of the advantages of such a system is flexibility – lights can be turned on and off individually, based on need, and can be controlled remotely. If they're battery-powered, they can be deployed without any wiring. But again, the controller needs to know the location of each of the light bulbs or lighting units. Currently, when lights cannot determine their own location, project managers need to manage lists of locations of each wireless light deployed.

Obviously the easiest solution would be to put a GPS component into every Thing in the Internet of Things. But GPS components take significant space and power, and are impractical for most connected Things. Additionally, GPS doesn't work indoors.

New technologies are now reaching market that can track the locations of "Things" in the Internet of Things in an effective manner. These are emerging from the indoor location technology industry, but are valuable outdoors as well, in devices that are not equipped with GPS.

For those Things that use cellular data connectivity, and have SIM cards, technology from start-ups such as Glopos or W-Locate can calculate location positions based on data available from cellular networks. But only a minority of connected Things will have cellular connectivity, especially when considering large-scale sensor networks.

Another approach is to use a wireless communications protocol that supports precise measurement of distance and location. One such system is UWB, or ultra-wideband. This has reached market in a chip from DecaWave, in a board from Time Domain or Zebra Technologies, in a prototype phone from BeSpoon, and in technology from BlinkSight, and others. The single-chip implementation from DecaWave, for example, is amenable to integration into very small Things, including sensors, and is compliant with the IEEE 802.15.4-2011 standard.

The key to this approach is that these Things are already equipped with some sort of wireless connectivity, and use it to communicate with other Things and with their controller. Many Things use common wireless protocols from the mobile industry, such as Bluetooth and Wi-Fi. But many use more specialized protocols such as Zigbee, Z-Wave or others. UWB is an alternative that, in addition to supporting faster wireless communication than Zigbee, is also more suitable for very precise location estimation.

As more "smart city" and "smart building" projects get underway, and as more Internet of Things systems reach market, we expect location-awareness of Things to emerge as a new challenge. Which Internet of Things companies will incorporate location technology into their Things?

Several of the companies mentioned above, including Qualcomm, Google and Cisco, have also developed technology for tracking locations indoors or outdoors. If these approaches are not applicable to the Internet of Things, new location technologies such as those discussed above will need to be considered. Only then can we know where the Things are.