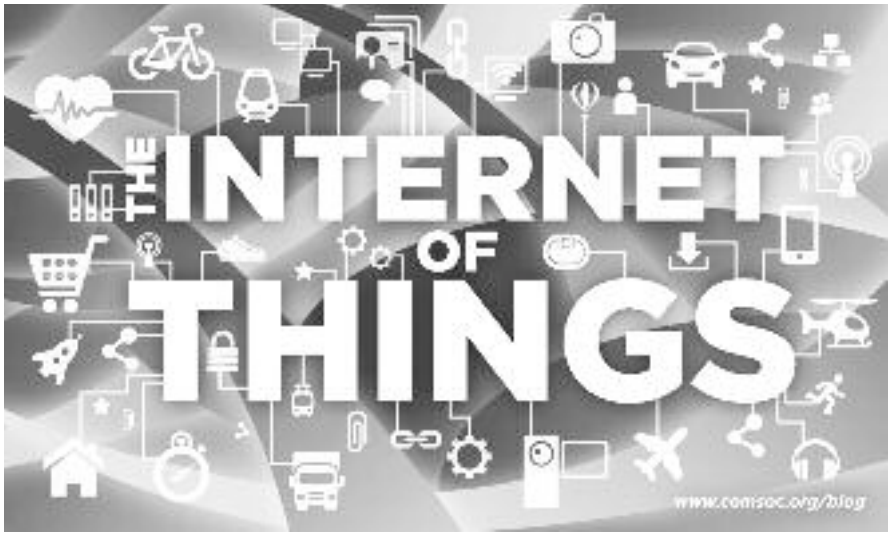

The Internet of Things

Moving toward a Smarter Internet

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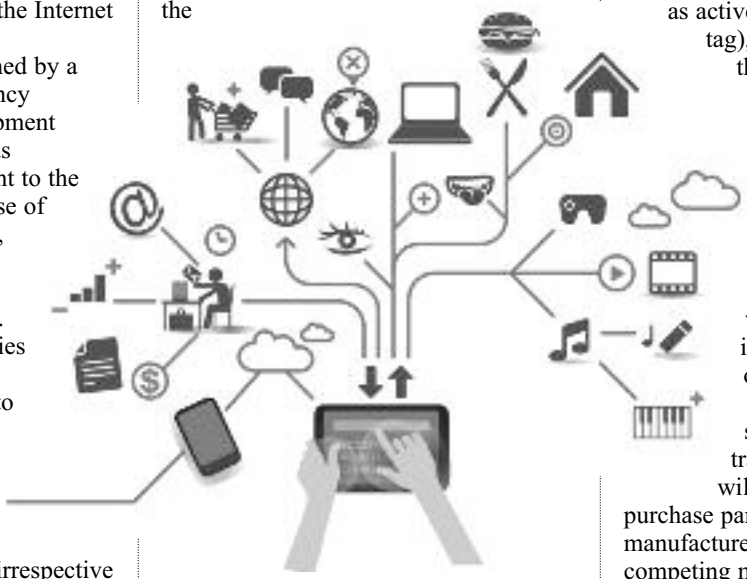
Imagine a world where billions of objects can sense, communicate and share information, all interconnected over public or private Internet Protocol (IP) networks. These interconnected objects have data regularly collected, analyzed and used to initiate action, providing a wealth of intelligence for planning, management and decision making. This is the world of the Internet of Things (IOT).

The IOT concept was coined by a member of the Radio Frequency Identification (RFID) development community in 1999, and it has recently become more relevant to the practical world largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics.

Since then, many visionaries have seized on the phrase "Internet of Things" to refer to the general idea of things, especially everyday objects, that are readable, recognisable, locatable, addressable, and/or controllable via the Internet, irrespective of the communication means (whether via RFID, wireless LAN, wide- area networks, or other means). Everyday objects include not only the electronic devices we encounter or the products of higher technological development such as vehicles and equipment but things that we do not ordinarily think of as electronic at all - such as food and clothing. Examples of "things" include : People; Location (of objects); Time Information (of objects); Condition (of objects).

These "things" of the real world shall seamlessly integrate into the virtual world, enabling anytime, anywhere connectivity. In 2010, the number of everyday physical objects and devices connected to the Internet was around 12.5 billion. Cisco forecasts that this figure is expected to double to 25 billion in 2015 as the number of more smart devices per person increases, and to a further 50 billion by 2020.



With more physical objects and smart devices connected in the IOT landscape, the impact and value that IOT brings to our daily lives become more prevalent. People make better decisions such as taking the best routes to work or choosing their favorite restaurant. New services can emerge to address society challenges such as remote health monitoring for elderly patients and pay-as-you-use services. For government, the convergence of data sources on shared networks improves nationwide planning, promotes better coordination between agencies and facilitates quicker responsiveness to emergencies and disasters. For enterprises, IOT brings about tangible business benefits from improved management and tracking of assets and products, new business models and cost savings achieved through the optimisation of equipment and resource usage.

In today's IT industry, companies are staying competitive by adopting new technologies, streamlining business processes and innovating new services to increase productivity and save costs. In the logistics and supply chain, the traditional supply of goods is based on established agreements between manufacturers and suppliers. Orders are made in advance and tracking is done by various stakeholders in the supply chain, i.e., assembly lines, manufacturers and logistics managers. With the use of smart technologies such as active RFID (executable codes in tag), it is possible to envision that goods may be transported without human intervention from manufacturers to suppliers. Warehouses will become completely automatic with goods moving in and out; forwarding of the goods will be made, using intelligent decisions based on information received via readers and positioning systems to optimise transiting routes. Suppliers will have the flexibility to purchase parts from various manufacturers (possibly from competing manufacturers) and buy them in a sequence of individual orders. Such automation creates a dynamic production and transportation network and provides better asset management to improve the overall efficiency in the supply chain.

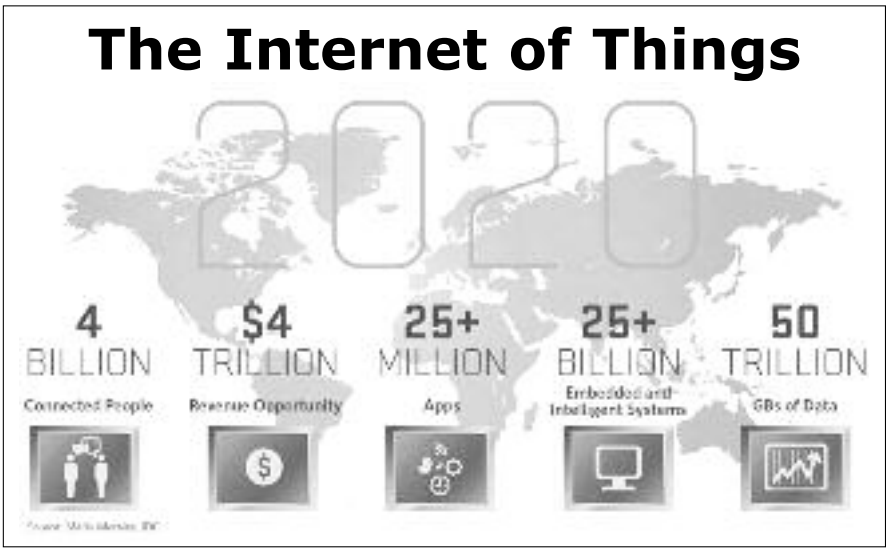
In healthcare, hospitals are shifting from providing healthcare on premise, ▸

i.e., in hospitals and clinics, to remote self-monitoring for patients. Self-monitoring benefits patients by giving them greater freedom and independence in monitoring their health and frees up hospital equipment for the treatment of emergencies. In the USA, electronic health monitoring has been given the go-ahead by the Federal Communications Commission (FCC). FCC allows the use of allotted frequencies for sensors to control devices wirelessly in the monitoring of health at hospitals and homes. Such monitoring allows doctors to inform their patients of critical conditions before they happen and subsequently improves the quality of healthcare by untethering patients from tubes and wires. FCC has also forecast savings of an average of US$12,000 per patient by decreasing hospital-acquired infections. Moving into the future, there are newer trends of developing biodegradable materials for sensors and "lab-on-chip" equipment that can be implanted on or in patients. The sensor chips can detect internal organ responses to new medication and guide the application of drugs to infected areas for better treatment.

In smart grid and metering, smart grid systems allow the monitoring and managing of the entire life cycle of power generation, transmission, distribution and consumption. Consumers traditionally do not have control over their exact consumption of power but are now empowered to manage and track their own consumption. This shift potentially creates huge saving for consumers and also for power companies as they are able to provision power at peak periods of the day. Frost and Sullivan has forecast 5% cost savings from changes in consumption patterns resulting from the ability to monitor consumption habits for consumers, and 10% cost savings on passive energy efficiencies related to smart grid implementation, e.g., diagnostic capability, conservation via voltage reduction and control, measurement and verification for efficiency. For example, in South Korea, a smart grid test bedding project is currently being trialled on Jeju Island where it will become the world's largest smart grid community to conduct testing of the most advanced smart grid sensor technologies and R&D results. The target is to achieve a 30% reduction of CO_2 by 2020, and achieve a low carbon economy and society capable of monitoring power consumption and distribution.

In automotive transportation, the traffic conditions today are monitored by cameras and motion sensors placed along major road junctions and highways. However, with road traffic growing and land space for road development restricted, these sensing technologies are reaching their limits in providing real-time traffic updates to ease road congestions and help prevent accidents. There are shifting trends in the automotive industry to equip vehicles with dedicated short-range communication (DSRC) to provide vehicle-to-vehicle (V2V) communications to improve vehicle safety and provide better road visibility for traffic management. For instance, when there is a traffic jam, the first car may tell the cars behind if there is an accident, and this will eventually inform the intelligent navigation systems to re-route the path to another less crowded road. These cars can make breakdown calls when appropriate, collecting data about the surrounding infrastructures such as traffic lights and buildings, and about itself (such as the faulty parts in the vehicle and type of loads it is carrying) in the event of an emergency. Vehicles gradually become smart "things" which can react, based on real-time situations on the roads, and contribute to a safer traffic system.

In retail, businesses have problems identifying the right customer at the right time to sell them their products. Various techniques of marketing products involve using short messaging system (SMS) broadcast, digital signages and recently the use of Quick Response (QR) codes to bundle promotions. These methods often fail to deliver the right customer to the right product and vice-versa. New trends of marketing have evolved with businesses shifting from mass market advertising to context-aware systems to anticipate customer needs and proactively serve the most appropriate products or services. For example, a male shopper, looking to buy business suits for a job interview, will be informed of exact store locations selling suits that match his body size, style and budget. Behind the scene, the context-aware system tries to understand the profile and sentiments of the male shopper, and combines data from the mall to "intelligently" make recommendations to suit the shopper. Gartner has forecast that context-aware technologies will affect US$96 billion of annual consumer spending by 2015, with 15% of all payment card transactions being made on the back of contextual information.



The use of RFID and near field communications (NCF) tags on packages, shelves and payment counters is also being gradually adopted by businesses to enhance retail experiences. It is estimated that an estimated 2 billion phones will be sold by 2012. Almost every phone will have RFID and NFC readers, meaning that eventually shoppers will no longer need to consult salespersons or floor readers to know the history of a product. They can simply scan the product tags using their mobile phones (or the shelves if the products are sold out). Virtual shopping carts can be created and orders placed automatically with warehouses for goods to be delivered to their homes.

So, from shoe to headphone, everything will be connected. The real question is whether that will bring only comfort or any hidden danger for human being? That is an open question. CJ