



Summing up IoT

Internet of Things – A key enabler in digital transformation

Alan Carr, Director Mobius Consultants Limited

The Internet of Things (IoT) is one of the most talked about digital technology enablers. IoT is already transforming established industries including creating entirely new business models and the pace of change is increasing. But what exactly is the current “state of play”, what are the most promising applications areas and what should companies be doing about it?

IoT . a digital enabler

Masayoshi Son, the charismatic CEO of Softbank has likened the Internet of Things (IoT) to the Cambrian explosion some 550m years ago when thousands of new species appeared on earth. His view is that in the next 20 years there will be a trillion IoT connected devices. This was the driver for his company acquiring the UK technology company ARM in 2016.

The number of mobile phone users worldwide is approaching 5bn and there is therefore limited room for further growth amongst a global population of 7m. Some five year ago, IoT emerged as the logical next step . start connecting %things+since the majority of people are already connected. Since then, IoT has become one of the most important enablers of the digital revolution. For example, IoT makes the %connected car+possible which in turn is leading to digital transformation in the automotive sector.

IoT in practice

The term Internet of Things implies a situation where devices are connected to the internet and can communicate with each other in the same way people communicate using the internet. In reality, current IoT applications are significantly different from this. Some, such as phone-based central heating applications are merely remote controllers, whereas others only operate over only short ranges such as in home automation systems. In other cases, such as an automatic meter reading, there is a network of connected devices, but the system is not accessible over the global internet and is really an intranet of things. IoT is also sometimes known as machine-to-machine

(M2M), a term which focuses more on the communication path than the internet aspect, although both terms are used interchangeably and IoT has recently come to dominate.

Despite the term IoT being inaccurate and the fact that some applications can be quite trivial, taken as a whole IoT is a very powerful concept which will transform many established businesses and will create entirely new ones. As such, IoT is probably the most significant single driver for the digital revolution.

To gain a deeper insight, it can be broken down into three main areas according to the type of communication used to link the nodes together.

Cellular based IoT

Here a cellular mobile network is used as a basis for IoT. Initially this was done using 2G (GSM) and 3G networks with little modification. More recently, specialised modes have been developed to suit IoT. A system (EC-GSM-IoT) has been developed for GSM networks, but of greater interest is a variant of LTE known as LTE-M. This system operates over a narrower bandwidth than normally used for LTE communications and includes special IoT features such as power saving techniques. Most recently, the 3GPP organisation has developed NB-IoT, a system using only 180kHz of bandwidth and focused on high building penetration, low-cost terminals and very low power consumption. Although late starting, NB-IoT is now the subject of several deployments worldwide and semiconductor manufacturers are already making chips available.

Not surprisingly, cellular IoT systems are promoted mainly by mobile operators. Some, such as Vodafone, have taken a lead role and offer solutions to multiple industry sectors. One reason IoT is attractive to operators is that their businesses have plateaued as mobile markets have become saturated and IoT is seen as an area for new growth. One issue is that most mobile operators struggle to provide a one-stop solution for IoT applications including in unfamiliar areas such as device customisation and business solutions.

Low power wide area (LPWA) IoT

An alternative to a cellular solution is to use a separate network specifically developed for IoT applications. In view of their specialised nature, these systems can provide features specific to IoT applications such as wide area coverage, good building penetration, low cost devices and low power consumption. Typical targets are a cost of \$2 per device and power consumption for a 10-year battery operation.

One of the most widely available systems is that developed by the French company Sigfox. A range of non-cellular operators have been recruited to build Sigfox networks in more than 30 countries and the system concentrates on battery life and low cost devices. There is also a range of other systems at various stages of development including LoRaWAN, Weightless and RPMA.

A challenge for these systems is the launch of the cellular-compatible NB-IoT system from the powerful 3GPP organisation. Although there are inevitably compromises in a system designed to be a component in a cellular network, NB-IoT appears to be gaining traction after a slow start. In the past, 3GPP systems have come to dominate when alternatives have appeared, the most famous example being WiMAX. Of course, events could be different for IoT, but this is an issue to be taken account of when considering a non-cellular LPWA solution.

Short-range IoT

Short-range communication systems such as WiFi, Bluetooth and ZigBee can be used in some IoT applications. WiFi has probably the greatest potential and is especially relevant for in-home applications. This approach has the advantage of simplicity and low cost, especially where a WiFi is already available such as in homes. Short-range IoT systems are also of interest in industrial

applications where they can be used in a factory or process plant as a more flexible alternative to conventional control and monitoring systems.

WiFi terminals are not generally optimised for low power, but this is not a problem for applications such as cookers, coffee machines, etc where power is available. A more pressing problem is the practical issue of how to follow the familiar procedure for registering a device with a WiFi router when the device has no keyboard or display. There are potential solutions, but none are perfect and standardisation work is in progress for a better way forward.

Implementation issues

In reality, IoT is a coming together of several technologies including: wireless communications, fixed networks, cloud, artificial intelligence, data mining, software, various IT technologies, semiconductors and smart devices.

Security and privacy are key issues. Security is needed to counter threats to data and deployed devices. Privacy is important to keep sensitive data secure . for example data in medical applications. This is an area where cellular systems have an advantage since the SIM concept as used in mobile phones can be applied, albeit probably in the form of an embedded SIM since physical SIMs are too cumbersome in most applications. Another technology expected to have an important role is blockchain which allows the construction of non-editable data records where there is some form of transaction.

The supply chain for IoT is unusually complex. First there are the communication providers which may include a cellular operator or an LPWA carrier. Other providers produce generic platforms of various types. For example, Jasper (now owned by Cisco) provides a widely used IoT platform upon which applications can be built. Other providers offer infrastructure such as cloud solutions or middleware solutions. Then there are providers of specific components such as semiconductor manufacturers, device manufacturers and radio equipment companies. In view of the disparate nature of the IoT supply chain, partnerships and ecosystems and particularly important since, in most cases, no one supplier can provide a full solution.

Applications

Arguably, the most active applications for IoT so far have been in:

- Remote meter reading and smart metering for energy efficiency and better supply infrastructure. Typically driven by governments, this is a classic, although rather specialised IoT application
- Industrial applications including manufacturing and process control. Here IoT is used as a more powerful and flexible equivalent to existing control and monitoring systems
- The connected car for a host of monitoring, navigation, entertainment and communications applications. And, of course, IoT is a key enabler for the well-publicised computer-driven vehicle. This is clearly a major application area still at an early stage of development.

Predicting the main future areas for future activity is a difficult task. However, it seems likely that the following will be important:

- Smart city applications such as rental bikes and cars, street lighting, parking, etc. A key goal here is to connect together systems in the city that have previously operated separately
- Healthcare including systems available directly to consumers (eg fitness and vital signs monitoring) and those requiring involvement from healthcare providers (eg remote medical

consultations or even surgery). One objective of the wider digitisation of healthcare, including IoT, is to move from payment on a treatment basis to payment for outcomes.

- Consumer devices for smart homes . for example connected TVs, cookers and washing machines
- Asset tracking for everything from ships and lorries to wind generators and machine tools
- Financial applications including dynamic insurance pricing, automated distribution and better investment decision making
- Military applications including for drones, autonomous systems, tracking and intelligence gathering.

Our view

Although IoT attracts a lot of interest at the current time, it can be argued it is not really a technology in its own right, but rather a coming together of multiple technologies enabling a step change in connectivity. We believe the term IoT will cease to exist in 10 years and instead the principles will be embedded as fundamental and integral parts of the industries where they are used. But this is not to diminish the importance of the subject . IoT will undoubtedly have a transformative impact in the shift to a connected digital world or, to put it another way, IoT is an extension of digital into the physical world.