

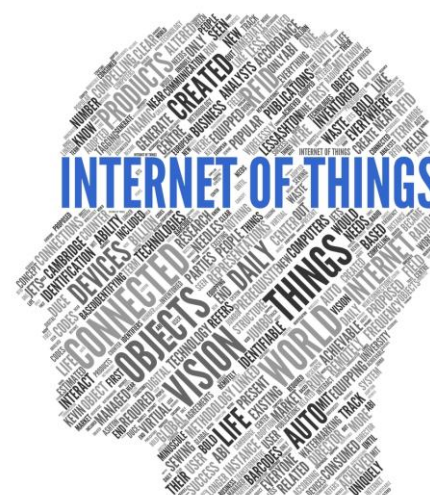
EdenTree SRI Expert Briefing – December 2014



The Internet of Things

Introduction

The scale and reach of the third great socio-economic revolution in the modern era has seen us dedicate two Amity Insights to exploring the Digital Planet. In Part II, 'Big Data: Small World', we make reference to 'The Internet of Things' a concept that we believe will have a significant long-term impact for every business sector. In this SRI Expert Briefing we explore the concept of 'The Internet of Things', and what it means for people, profit and planet.



Q. What, simply put, is 'The Internet of Things'?

A. In 2000 the MIT based Auto-ID Center in a white paper envisioned 'a world in which all electronic devices are networked and every object, whether it is physical or electronic, is electronically tagged with information pertinent to that object...thus enabling all physical objects to act as nodes in a networked physical world'.¹ This early 'blue-skies thinking' is now becoming a reality with 'The Internet of Things' (IoT). 'The Internet of Things' thus refers to the ability to offer advanced connectivity of devices, machines and operating systems beyond normal machine-to-machine network capability. At its simplest, the evolution of Smart technology is making it possible to connect disparate protocols, domains and applications, ushering in near automation in all fields and applications. By 2020, it is estimated that there may be as many as 26 billion devices connected to 'The Internet of Things'². It does not concern objects so much as the relationship between objects in the physical world, harnessed to the virtual world.

Q. What are some of the applications?

A. The most commonly discussed application is the example of all domestic appliances being controlled remotely via sensors – for instance heat, lighting and security controls, or even variable refrigerator temperatures depending on external factors. Smart data will allow information to be collected and processed to affect buildings and factories, or allow smart shopping monitoring in-store purchases via mobile phone tracking technology. The information would be used to 'suggest' special offers linked to individual consumer habits. The real change offered by 'The Internet of Things' is to achieve an effect in real time rather than retrospectively. There will be huge – positive – implications for environmental, industrial, energy, medical & healthcare, transport and infrastructure management.

Q. Can you give some examples?

A. The 'Internet of Things' allows for the integration of previously discrete networks or systems. In transport, the integration of communication control and information will allow a dynamic interaction between the variable components of a transportation system – for instance, indicating to individual customers by Smart technology where seats may be found on a discrete service in advance of it arriving. In the field of medical and healthcare, 'Internet of Things' enabled devices will be used to enable remote health monitoring, e.g. blood pressure, heart rate or the operation of specialised implants. Variations in activity could result in remote intervention, or in worst-case scenarios, auto-dial emergency attendance. Specialised sensors can be equipped to monitor the health and well-being of elderly citizens living alone or in

isolated communities. Wearable heart monitors linked to Smart technology is the obvious manifestation of this trend. We view e-health and tele-medicine to be a potential cornerstone of smart 'medilytics' given the ageing population.

Q. Sensors seem to be at the heart of 'The Internet of Things'?

A. Sensors are the conduits of enhanced connectivity. We are only just beginning to glimpse the potential for what may be achieved. Billions of individual sensors are being attached to millions of devices, connecting everything with every individual, essentially creating a vast 'digital neural network' that extends across the planet and all economies. Already 14 billion sensors are attached to warehouses, factories, road systems, the electricity generation grid, stores and homes, monitoring the status and performance of infrastructure that feeds into Big Data analytics³. By 2030 it is estimated that there will be 100 trillion sensors connecting the human environment in a vast digital intelligence network⁴.

Q. What is the value of the remote control market?

A. Cisco (Amity Global Equity Income) is a key participant in the technology to make 'The Internet of Things' a reality. According to its Chief Executive, this is potentially a \$19 trillion market⁵, drawing a picture in which homes, airports and hotels are interconnected to determine individual preferences, leading to higher levels of consumer activity. He also outlined key social and environmental positives arising from greater connectivity such as linking waste collection and disposal which could reduce waste management costs by as much as 30%. Cisco is at the forefront of designing technology centrally linking health and educational systems within cities. This could boost global profits by 21% by 2022⁶.

Intel (Amity Global Equity Income; Amity International) is developing 'Internet of Things' technology built around its intelligence architecture. Intel provides the building blocks for 'Internet of Things' functionality connecting, securing, managing and analysing data. Intel makes the point that no single technology provider can enable 'The Internet of Things' alone, and that it sits at the heart of a vibrant eco-system that brings it altogether. These 'ingredients' include processors, modules and operating systems, security software, original design manufacturers (ODMs) that build boards which end up in equipment delivered by Original Equipment Manufacturers (OEMs). Systems integrators turn these ingredients into industry specific solutions complete with data analytic software and network services. There is investment opportunity at every point of 'The Internet of Things' value chain.

Q. Isn't this all a little like science fiction?

A. It may seem so; however in 1993 it would have been impossible to predict the influence the Internet would have on every aspect of human society. In less than 20 years, Smart devices and cloud computing has made 4,000 Exabyte's (a multiple of the unit 'byte' being 10¹⁸) of information available - by way of example if 4,000 Exabyte's were a stack of books, they would extend from Earth to Pluto and back 80 times⁷. Smart access is now available to 90% of the world's landmass; by 2032 it has been estimated that 'The Internet of Things' could reasonably connect us, as individuals, to between 3,000 and 5,000 'things,'⁸ linking people, animals, buildings, appliances, plants or soil to 'The Internet of Things'. It may be some way off, but ultimately in return for ceding a little human control, artificial intelligence could quite possibly allocate resources for the greatest mutual benefit and efficiency actively regulating the health, safety and security of citizens.

Q. What are the issues for responsible investors?

A. In our two-part Amity Insight 'Digital Planet' (November 2014) and 'Big Data' (January 2015), we point to a series of emerging challenges that arise as part of the digital revolution. Whilst we are optimistic that the overwhelming benefits will be positive, the transition to connected data presents new threats, many as we argue in 'Big Data', currently outside a defined ethical framework. The European Group on Ethics in Science and New Technologies asserts that 'The Internet of Things' will change '*radically the relationship between humans and...interconnected autonomous objects*'⁹. The kinds of ethical issues of concern to responsible investors may well be novel and unfamiliar, but they will have a serious

impact on the ability of 'The Internet of Things' to be a benign and positive influence for humanity. Major issues include autonomy (who is in control?), security (dual-use, freedom, access) and equality (absence of discrimination and fairness). Ubiquity and pervasiveness make these generic rather than specific ethical challenges – everyone embracing 'The Internet of Things' will be affected.

- *Social Justice & the Digital Divide – there is no democratic institutional framework that evaluates the way networks distribute benefits, nor how they may discriminate. Networks will need to develop greater visibility and transparency models so that maximum benefit and understanding can be embraced*
- *Trust – boundaries between 'public' and 'private' are becoming blurred with little visibility around information sharing and transfer. Networks will need to be able to demonstrate effective security resilience and privacy management. Non-human entities are likely to exhibit 'smart autonomy' and therefore Networks will need to evaluate what it means to trust 'a thing, person or service' in an 'Internet of Things' context*
- *Dominant sector players – there is the fear that a few technocratic companies will come to dominate access to all information and knowledge in a previously unforeseen and unrealised way. To some extent this has already happened with the omnipresence of SMART technology eclipsing all other mobile communication technologies in a handful of years. Apple is the world's most valuable company selling 169m I-phones in 2014¹⁰. Whilst it dominates the smart phone handset market, competition effectively means that it does not control the operating systems to support them; in the UK nearly 60% of SMART devices run off Android (developed by Google)¹¹. Whilst we believe those with dominance in 'The Internet of Things' market will be benign, ('do no evil' in Google's corporate motto), we note the challenge from operating in an environment lacking a defined ethical framework. In 'Big Data' we call this 'entering the ethical void'*
- *If the Internet is already vulnerable to cyber-attack, how much more resilient and robust will 'The Internet of Things' have to be. Connecting the physical world to 'The Internet of Things' creates significant vulnerability for everything – the hacking of Iranian nuclear facilities in 2012 being a good example. For governments and citizens alike, the risk from crime, hacking and terrorism will only grow bolder and more insistent. However, it also creates significant opportunity for security software and systems developers.*

EIM is well represented throughout the digital value chain from processors to data centres to take investment opportunity from the technological shift we have explored in our two Insights, 'Digital Planet' and 'Big Data'. In particular some of the applications envisioned by 'The Internet of Things' such as e-health and tele-medicine may be truly transformative in terms of monitoring, patient care and health economics. We are alive too to the many emerging risks and will routinely engage with companies to understand how these challenges – security, privacy and inclusion – are being met.

The EdenTree SRI Team

We have a specialist in-house Socially Responsible Investment (SRI) team who carry out thematic and stock-specific research to identify ethically responsible investment ideas for our range of [Amity Funds](#). Headed up by our Senior Investment Analyst Ketan Patel, CFA, and Neville White, Head of SRI Policy & Research, the team is also responsible for creating an on-going dialogue with companies, allowing us to engage on a wide variety of ethical and socially responsible investment concerns. For investors, it's an added layer of assurance that client money is being invested in companies that are operating in a responsible and sustainable way. Our ethical and responsible investment process is overseen by an independent [Amity Panel](#) that meets three times a year, and comprises industry and business experts, appointed for their specialist knowledge.



EdenTree - Ethical Investment Specialist



Since launching the [Amity UK Fund](#) in 1988, EdenTree has taken a leadership role in managing ethical investments through our research, engagement and strong fund performance. Consequently, we were delighted to receive the Moneyfacts Award for Best Ethical Investment Provider 2014. This was the sixth consecutive year of winning this award. We were particularly pleased to win as it is voted for by the IFA community. In 2013, the [Amity UK Fund](#) was rated 'Highly Commended' in the Investment Week Climate Change and Ethical Investment Awards. We were also awarded Money Observer Best Ethical-SRI Bond Fund for the [Amity Sterling Bond Fund](#), and the [Amity UK Fund](#) won Best Equity Fund in the 2014 Money Observer Ethical/SRI category. Today we offer six SRI funds, four under our Amity banner and two charity funds, covering the major markets and investment classes.



Further information

For further information on EdenTree's SRI range of Amity Funds please contact your EdenTree Business Development Manager, visit www.edentreeim.com or call our IFA support team on 0800 011 3821.

Please note that the value of an investment and the income from it can fall as well as rise as a result of market and currency fluctuations, you may not get back the amount originally invested. EdenTree Investment Management Limited (EIM) Reg. No. 2519319. Registered in England at Beaufort House, Brunswick Road, Gloucester, GL1 1JZ, UK. EdenTree is authorised and regulated by the Financial Conduct Authority.



Notes:

¹ Sarma S and Brock DL, 'The Networked Physical World: Proposals for Engineering the Next Generation of Computing, Commerce and Automatic Identification. Auto-ID Center, MIT Cambridge MA 2000

² Gartner Inc. 12 December 2013 <http://www.gartner.com>

Market Watch Jeremy Rifkin 'Say goodbye to Capitalism as we know it' May 2014 <http://www.marketwatch.com/story/say-goodbye-to-capitalism-as-we-know-it-2014-05-15>

⁴ Rifkin *ibid.*

⁵ Bloomberg 'Cisco CEO Pegs Internet of Things as \$19 trillion market www.bloomberg.com/news/2014-01-08/cisco-ceo-pegs-internet-of-things-as-19-trillion-market.html

⁶ Bloomberg Cisco *ibid.*

⁷ The Internet of Things TED Talk Dr John Barrett Cork Institute of Technology <http://tedxtalks.ted.com/video/The-Internet-of-Things-Dr-John>

⁸ Barrett *ibid.*

⁹ European Commission White Paper 'Fact Sheet- Ethics Subgroup IoT' van den Hove - Delft University of Technology March 2013

¹⁰ Statista Inc. <http://www.statista.com/topics/847/apple/>

¹¹ Statista *ibid.*