The Internet of Things: the continuation of the internet

The 'Internet of Things' – the interconnectivity of all kinds of devices, from tablets to televisions, on a huge scale – is increasingly entering both the lives of consumers and businesses, presenting challenges for governments as well as changes in how we as a society live. Ben van Lier, Director of Strategy & Innovation at software solutions, IT outsourcing, business process outsourcing and staffing services company Centric, outlines the functioning of the Internet of Things, the changes it will usher in, and why EU governments must alter their traditional vision of industrial production to accommodate it.

Last year one of my daughters purchased a new television for her room. A nice model, with a good picture and of course 3D possibilities, which in this day and age are important to enjoy watching television and films. The choice of this particular model was partly determined due to the fact that the television featured the possibility to be connected to the internet. I was able to, with some difficulty, create a wireless connection between the television and the home network by means of Wi-Fi. By way of this wireless connection there is the possibility to maintain social networks such as Twitter, Facebook or LinkedIn whilst watching 'traditional,' but digital, television. This television, with its connection possibilities, therefore also subtly brings the Internet of Things closer, and brings this concept into our house and our private lives, without there ever being a link to this concept being made. The new possibilities that the television with internet capabilities offers also have a flip side: This development comes at the expense of the future of the DVD, for instance. The profit made from DVDs in the Netherlands will decrease this year from EUR 227 million to EUR 165 million. The expectation for next year is that it will drop to a mere EUR 74 million. The DVD seems to be meeting an inglorious end, just as the VHS video did a few years ago. In contrast to this decrease in DVD sales is the huge rise in 'video on demand' where viewers can order or download free television programmes or paid films and TV series via the internet to watch where and when they wish. In this example of the TV, we show the consequences of connecting one object in a random network. In the coming years, billions of objects will be connected into networks.

Connecting objects in networks

Last year Rand Europe was commissioned by the European Commission to carry out a study into the question of how the development of the 'Internet of Things' can be stimulated within the European Union. The results of this study were recently published. In the report, Rand Europe states that the 'Internet of Things' is a logical continuation in the development of the already existing internet. In this next step, more and more physical objects such as the television are connected to the internet. According to Rand Europe, by connecting physical objects to the internet, 'a pervasive and self-organising network of connected, identifiable and addressable physical objects, enabling application development in and across key vertical sectors through the use of embedded chips' will emerge. By interconnecting physical objects in networks to an Internet of Things, not only are the functionalities of individual physical objects strengthened and expanded, but new functionalities and capabilities are created at the same time, which will influence the entire process of development, manufacturing and maintenance of these physical objects. According to Rand Europe, within the next 10 to 15 years, the development of the Internet of Things will form an important part of the European digital economy, but its development now is certainly not yet aligned with European policy or European regulations. The latter is partly because the development of the Internet of Things is happening largely beyond the reach of both European governments and European industry. For instance in 2012, General Electric (GE) published its vision on the development of the 'Industrial Internet,' in which intelligent machines are connected to each other in networks, even at the component level. Within these networks, intelligent machines are able to communicate with each other and with people, irrespective of the time and place in which they find themselves. In GE's vision, intelligent machines are thus combinations that consist of options emerging from the industrial revolution and the IT revolution. The new revolution of the industrial internet is shifting the existing boundaries between people, software and machines, and in some ways also blurring those dividing lines. Slowly but surely, according to GE, this revolution is leading to an industrial Internet of Things, and is poised to radically transform our daily lives and ways of working.

Another name for Intelligent Machines is Cyber Physical Systems. The American Institute of Standards and Technology (NIST) describes these Cyber Physical Systems as 'smart systems that encompass computational (i.e., hardware and software) and physical components seamlessly integrated and closely interacting to sense the changing state of the real world.' In the philosophy of the NIST, examples of Cyber Physical Systems include robots, intelligent buildings and medical implants. One of the most important challenges in designing, developing and managing these Cyber Physical Systems is the collaboration between Cyber Physical Systems and people. Issues that play a role in the context of this collaboration concern being able to define and model 'situational awareness,' the human experience of these systems and the environment created by them, and changes in circumstances and/or parameters that can be critical when taking decisions, to name just a few examples. In the vision of the NIST, Cyber Physical Systems form the foundation for developments such as Smart Manufacturing, Smart Health, Smart Grids and Smart Buildings. The development of the Industrial Internet will influence, as shown here, the existing industry and lead to new forms of organising and organisations.

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Interoperability of information

The increasing number of connections between people, organisations and objects in networks such as in the Internet of Things contributes to a further global informatisation. This increases the economic dependency on information in our society even further. Information becomes increasingly self-evident in our living and working environment. More and more machines not only communicate with each other (machine-to-machine) but also with people. Because of this communication, man and machine will have access to shared information on the basis of which they can act and produce. The latter is called 'interoperability of information.'

Interoperability of information is the establishment of mutual connections between two or more systems or entities to enable them to exchange and share information in order to further act, function or produce on the principles of that information. Interoperability of information not only takes into account the technological possibilities of exchanging and sharing information but also the semantics and context of this information. The growing dependency on information raises the question of what information exactly is. In 1948, Claude Shannon formulated his mathematical theory of communication. Thanks to this theory, he was able to have a message in the form of a unit of electrical signals, sent by a random device, be exactly reproduced by another, receiving device. To be assured of an exact reproduction by multiple random devices, Shannon had to strip this message from any meaning in the form of semantics and context. By doing so he was able, on the one hand, to limit the complexity of this matter, and, on the other, to reduce it to a matter that only needed to be understood by technicians. The idea was that the more precisely a sent unit of electrical signals could be selected by a random receiving device, the more reliable the information. Shannon called the measurement unit of these electrical signals binary digits, or bits for short. This limitation applied by Shannon could form an obstacle in the further development of the Internet of Things as van Lier states (2013). In a positioning paper recently published in the UK, compiled by the Internet of Things (IoT) Special Interest Group, the possibility of being able to share and exchange information between actors (humans, physical objects, organisations, et cetera) in these global networks is seen as the biggest challenge.

Conclusion

The evolution of an Internet of Things is an inevitable development that may set in motion many new economic developments. The development, manufacture and maintenance of networked physical objects will have profound implications for the process of developing, manufacturing and maintaining industrial products. As McKinsey rightly notes, this also makes it necessary that European governments transform their traditional vision of industrial production as a source of mass employment to industrial production as a 'critical driver of innovation, productivity and competitiveness.' European governments play a crucial role in this technological and social transformation, in particular in terms of the development and design of education and research that can lead to the qualified staff needed to make this transformation possible and to keep European industries globally competitive. Despite the uncertainty that every transformation process entails, close European cooperation between government and industry may provide answers to the question: 'As we make things work, what kind of world are we making?"

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