

# Unpacking the 'Thing' in the Internet of Things

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## Abstract

We have arrived at a critical juncture in the history of information systems. Billions of electronic nodes (commonly called “things”) are now linked to the internet and by 2020 the number of such nodes will increase to 50 billion. These devices will help shape the environment we live in, analyzing, controlling, monitoring, and optimizing our world. Mankind is now going through a transformative era during which the advent of the Internet of Things (IoT) will signal a major shift in our technical and socio-technical landscape. This shift will be as significant as the introduction of the PC and will integrate several core information technologies including mobile communications, cloud computing, and data analytics. Guided by Heidegger’s thinking, and using the IoT Nest device as a case-in-point, we advocate an approach to the future research of the nascent IoT phenomenon that would take account of (a) individuals’ sense of proximity and its influence on their engagement with the world around them, (b) how people conceive of the things around them, and (c) how they relate to the basic constituents of the world.

**Keywords:** IoT, Internet of Things, Heidegger,

## 1 The Internet of Things

In 1999 the term Internet of Things (IoT) was first proposed by Kevin Ashton during a presentation at Procter & Gamble in the context of the emergence of sensor technology. In the intervening 16 years a number of enabling technologies have created the opportunity for the potential of the IoT to be realized:

- The expansion of the Internet Protocol IPv6 address space means that the Internet can now support an almost limitless number of IoT devices
- The decline in costs of processing power. Processing costs have declined by nearly 60X over the past 10 years. Sensor prices have also dropped to 60 cents from \$1.30 in the past 10 years.
- The cost of bandwidth has also declined by a factor of 40X over the past 10 years.
- The pervasiveness of Smartphones. Smartphones are now becoming the personal gateway to the IoT.
- Ubiquitous Wi-Fi coverage is generally available at a very low cost, or for free
- The power of big data analytics to analyse voluminous data is a key enabler.

Mazhelis et al (2012) provide a number of definitions for the term Internet-of-Things, some of which are summarized in Casagras (2009), Atzori et al. (2010), and Bandyopadhyay and Sen (2011). In general, the following three complementary – and partly overlapping – visions can be distinguished:

- (a) The “Things” oriented vision focuses on the things’ identity and functionality, which is in line with the original idea presented by MIT for using RFID tags to uniquely identify things,
- (b) The “Internet” oriented vision emphasizes the role of the network infrastructure and is concerned with the applicability of the available Internet infrastructure, including IP protocol stack and Web standards for the purpose of interconnecting smart objects and
- (c) The “Semantics” oriented vision which focuses on systematic approaches towards representing, organizing and storing, searching and exchanging the things-generated information, by means of semantic technologies (Toma et al. 2009; Barnaghi et al. 2012).

### 1.1 Motivation for this research

In the Information Systems community, the prevailing strategic research agenda for the IoT has been dominated by a somewhat technologically deterministic perspective on IoT, heavily influenced by the three visions mentioned above in which IoT represents “a global network and service infrastructure of variable density and connectivity with self-configuring capabilities based on standard and interoperable protocols and formats which consists of heterogeneous things that have identities, physical and virtual attributes, and are seamlessly and securely integrated into the Internet” (Tarkoma and Katsanov, 2011).

In the recent Call-for-Papers for the Special Issues of the European Journal of Information Systems it has been asserted that philosophy in IS is undergoing something of a renaissance. Indeed, there is an active and growing malaise in some quarters of the IS research community relating to the lack of philosophical and critical thinking in the community generally. This malaise was most effectively articulated recently by one of the senior scholars in the field when he pointed out that there is a need for “*an increased use of critical approaches, welcoming other disciplines with open arms, widening our field of study to many non-traditional settings and rejecting a dominant methodological paradigm*” (Walsham G., 2012). Walsham’s paper was, in effect, a call-to-arms for the IS research community to re-assess the IS research agenda in which he argues that if the IS field is to inspire in the future, the field needs a more rounded multi-disciplinary agenda. He rationalises this position as follows: “*Architects want to build better buildings, medics want to help people live longer and healthier lives, engineers want to build more effective technological systems to improve efficiency and artists want to stimulate our subtler senses with their work. IS scholars and practitioners should be concerned with how to use ICTs to help make a better world, where everybody has the opportunity and capability to use technologies to make better lives for themselves, their communities and the world in general*” (op cit.),

This paper aims to contribute to this discourse on broader and deeper conceptualizations of emerging IS phenomena such as the IoT. By drawing on the work of Heidegger and applying concepts such as the “fourfold” we hope to stimulate a more thoughtful treatment of IoT and expand the nascent research agenda in this area.

## 2 A Heideggerian, Pragmatic Perspective on IoT

Pragmatism has been characterized in a wide variety of ways. Probably the most pervasive of those characterizations turns on the distinctive way in which pragmatists have tended to understand the content of concepts, or determine the meanings of sentences or words. “Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of those effects is the whole of our conception of the object.” (Peirce, 1932). This pragmatic direction in semantics is well exemplified by the above quote from Peirce. It has been argued that there is a deep and important agreement between the Heidegger of *Being and Time* and the pragmatists, an agreement that accounts for the similarity of their views regarding linguistic meaning and the contents of concepts. This agreement concerns what it is for an agent to be intentionally engaged with a world, or, in more overtly Heideggerian terms, the basic constitution of the Being of Dasein (Orkent 1988).

In unpacking the thing, we take a Heideggerian approach to the ‘Thing’ and how the ‘Thing’ does work in the world. A useful heuristic to guide the discussion is the contention that we are familiar with objects and places due to our experiences of using them, not by holding them in an intentional manner in the mind, or considering them in abstract cognitive ways. Heidegger explains how Dasein is in the world – how it is involved with the world and the entities in that world – through the concept of care. Care (*Sorge*) is “the structure of Dasein itself” (Heidegger 1992: 293), and is both an existential (ontic) and ontological category of Dasein as Dasein necessarily cares for the world through its involvements with equipment (*Concern; Besorge*) and being-with others (*Fürsorgen*). Care is part of the structure of Dasein as a thing in itself (ontologically), and existentially is how Dasein is related to the world through its care for the world: “The authentic relation of the world and Dasein is care and meaningfulness” (Heidegger 1992: 221). Therefore, care (taking up of things in use) is how the world becomes meaningful to us. Care is not only concerned with Dasein and other entities that are Dasein (other humans), but also with equipment and things or objects in the world. The understanding that Dasein has is not factual - that is the knowledge derived from empirical or positivist observation that is the method of the empirical sciences - but is instead an understanding rooted in the way Dasein does things. An understanding of carpentry is shown in the way I handle a hammer and nails, and construct something from wood, not from my knowledge of the physical properties of the wood. Dasein's understanding of the world does not come from a factual understanding of the world, but instead knowing how to live in the world. Familiarity with the world comes with understanding why things are done in the manner in which they are done in the world. Such ruminations on care do not really explain what a ‘Thing’ does. In Heideggerian parlance, when a Thing “things”, it draws together elements in the world in a manner Heidegger called the fourfold (Heidegger 2008: 243).

The idea of the fourfold – earth, sky, mortals, divinities – is a simple oneness (Wrathall 2006: 112), which is how entities in the world exist if that entity has presence in the world as a ‘Thing’ rather than an object. There is some disagreement amongst commentators on how to interpret the fourfold as a concept. Harman (2002: 190) makes much of the unfavourable reception that Heidegger’s concept of the fourfold has received from not only critics of Heidegger’s philosophy, but also commentators that are

favourably disposed. As a result, many commentaries of Heidegger's philosophy ignore the concept altogether, and other critics are dismissive of the concept as pious gibberish (Harman 2002: 190). This may be for a number of reasons: the particularly poetic character of both the writing and the sentiment of the fourfold, the seeming irrelevance of the discussion of multiple essences from a philosopher synonymous with technological essentialism, or just the sheer oddness of the idea itself. Harman (2002: 190 -205) insists on interpreting the fourfold in an extension of his interpretation of all being as akin to the as structure of tools, that is in a constant cycle of withdrawal and revealing. Others, in particular Young (2002) and Wrathall (2006) instead consider the fourfold as the pivotal aspect of Heidegger's concept of dwelling.

Things in the world "thing"; they perform the function of "thinging" appropriate to what that thing is and its position in the world. For Harman (2007), the thing (when "thinging") produces a nearness to that thing. This nearness is when the thing produces a specific locale for being based around how that thing operates in the world, that is what its function is, how it gathers the elements and how this is given back to being as a revealing of the thing and its region, therefore providing an explanation of the (local) world.

The idea of nearness is vital to the understanding of the gathering (or event) itself and how this gathering related to dwelling. Malpas (2000: 218) argues that distance is the factor by which objects in a region are near or far (dis-stance). It is this dis-stance, the nearness or farness of an object, which decides whether an entity is a thing firstly, and secondly whether that thing can perform its "thinging", with a thing being existentially near in the region or locale. So, a thing is the critical aspect of the region itself in that without a thing, there is no region or locale (and hence the homelessness of man in the technological age). We dwell by attuning ourselves to the local world, and this attunement must be an attuning to things in that locale. This leaves open the possibility that different things "thing" in different ways as different things will be revealed and withdrawn in different ways according to their ontic properties. We dwell with things by not exploiting them, by not mastering them and by not subjugating them under our control (as we would if treating things as resource in a technological mode of understanding, Gestell or enframing in Heidegger's terms). In a Heideggerian view, the technological worldview is a danger in itself; not technology itself but the essence of technology which is a worldview which frames all entities as resources to be used. Dwelling with things - letting things come-forth as entities with their own essence - is to have a free relationship with technology rather than have the world structured by it.

The fundamental character of dwelling is caring for and protecting things (Young 2000: 189) and hence Being-with things is to take things into Being and hold them as concern. The character of the "thinging" is a function of the gathering of the elements of the fourfold. The four elements are earth, sky, gods and mortals, as is their relationship along two axes of earth-sky and mortals-divinities. The intersection of the four elements is the event or Ereignis. A local world where one can 'dwell' in a free relationship with technology occurs when an everyday thing "things" and temporarily brings things and people into their own appropriation.

Each element in this fourfold is simpler than their denotation suggests. The taken-for-granted practices that ground situations and give them significance as situations are earth. These practices, such as in Borgmann's (in Dreyfus and Spinoza 1997) example of the family meal, operate to make the gathering significant in that for a family such a dining practice is not an option to indulge in or not, but the basis upon which other

options appear (Dreyfus and Spinoza 1997) and in this paper as the practices for locating oneself, such as the check-in to Foursquare or the use of the Google map to orient oneself. Heidegger regards this grounding of practices as withdrawn and hidden, whereas sky is the revealed or manifest possibilities that arise from the focal situations (such as the family meal) and therefore is explicitly revealed. These are the possibilities for action that are appropriate for that focal gathering or locale in the case of the family meal, discussion of the day and warm conversation would be appropriate (Dreyfus and Spinoza 1997) while discussion of gory injury and death threats would not be appropriate. The possibilities of action are dictated by the situation which itself is disclosed by the fourfold.

By divinities Heidegger refers to the attunement of being in the situation to an extent that one feels in tune with what is happening and events unfold of their own accord without the need to push this unfolding through action. When a thing “things” this sense of divinity must be present, although this too will be withdrawn (Harman 2007: 132) such as the attunement of dwelling, which should not be thought of as explicit but as the mood in which Dasein is in at that time pre-reflectively. Mortals refers to how the thing “thinging” includes humans but in a specific sense. Obviously, the mortals will be revealed, but also act as disclosers of the thing “thinging” – and therefore the fourfold – itself, as without humans there would be no meaning to the gathering of the elements. Moreover, the choice of the word mortal is not accidental; the human revealing the thing and fourfold must be mortal in that they are being-towards-death, and therefore accepting of the finitude of Being, as only in this mode of Being can the disclosive way of being be revealed to us (Dreyfus and Spinoza 1997). Heidegger also means by mortals an attribute of the way human practices work that causes mortals to understand they have no fixed identity. This understanding is necessary if one is to attune to the locale and nature of practices demanded by the thing “thinging” and the possibilities that are appropriate for that locale (Dreyfus and Spinoza 1997).

The fourfold is the event of the thing “thinging” it gathers the four elements, and in doing so it reveals a local world of meaning that is dependent upon the thing. Wrathall (2006: 113) surmises Heidegger in that we dwell in the fourfold by “saving the earth, in receiving the sky, in awaiting the divinities and in accompanying the mortals.” In doing this, our being-in-the-world is a dwelling rather than a “homeless” or lost state. This fourfold way of living – saving, receiving, awaiting and escorting – cannot happen without things, and being-with things in a way that allows the fourfold to both be revealed and to be accepted into everyday being. This idea of dwelling being a skill is important as it implies that dwelling is something that is learned and therefore not learned in the technological age. In order to dwell in the technological epoch we would need to relearn the skills that are essential to realise dwelling and therefore reclaiming the essence of man, these skills being the practices that are attuned to the fourfold, no longer treating things as objects and subsequently as resource.

Heidegger holds that different things “thing” with different modes of revealing (Dreyfus and Spinoza 1997), and so each thing will gather the elements, or gather to itself, in its own way and manner. Dreyfus and Spinoza (1997) outline the possibility of dwelling with technology and a free relationship with technology. If there are local worlds produced by things thinging, then there is logically a multitude of these worlds that could be manifest to humans as things thing in different ways (as they gather in their own way) and that the human passes between these different world as he attunes

to different things at different times. This is an opening for considering the possibility of the technological thing thinging; if one can be with a technological device that gathers the fourfold in a way then a local world would emerge from its thinging. This world would have a character that may be defined as technological, but that still could be a local world. Dreyfus and Spinoza (1997) draw attention to Heidegger's analysis of bridges, and in particular to the autobahn bridge. While this is the modern, technological bridge it still exhibits a kind of gathering, not only a way of linking as many routes as possible (as resource). The sky is manifest as multiple possibilities (going this way or that); the earth is the possibility of these manifest possible routes, and the practices of crossing and encountering the bridge (albeit this is weak compared to the non-technical thing). The divinities would be the being in tune with technological flexibility, and the mortals would of course be the people using the bridge, aware of its revealing and with the skills appropriate to the world emergent from the "thinging" of the bridge. Dwelling can be seen as Heidegger's final response to the threat of enframing and holding all entities in standing reserve (Wrathall 2006: 109). The technological understanding of the world that is enframing reduces all being (the being of entities and the understanding of being) down to resource. In such an understanding we can use what we want with regards to the entities that we encounter in the world, but conversely there is no reason to do anything as all things are just surface; resources to be used and consumed but not to be used in any way to further understanding of the world or in the world. In dwelling, Dasein considers the entities in a locale as meaningful (not just resource) and hence that environment becomes a meaningful place.

Returning to the Internet of Things, we may accept that the devices and 'Things' that make up this nascent materiality are characterised by connectivity, data production and processing capabilities and the ability to communicate information. Therefore, as 'Things' in the Heideggerian sense devices in the IoT function to draw the requisite elements in an understanding of a locale in the digital world together: user, information and data, device, environment. One can map these onto Heidegger's own elements: mortals as user (that takes the device into care); gods/divinities as the feeling of place; skies as the information and data returned about place by the device; and earth as the embodied practices of use in a digitally-infused environment.

However, one must also consider that the use of the devices in the IoT may also be distanced from the user, while at the same time reducing the phenomenological distance that is characteristic of a Heideggerian 'Thing'. Berry (2011: 153) describes this as a 'vicarious causation' that encapsulates the way the world is presented through devices; the means of understanding the world (from the referential totality of all things in an existential locale) is necessarily vicarious through the way that those devices are continually emerging and withdrawing into the clearing of understanding that is the referential totality, due to the computational device itself has an internal hidden state through code. In Heideggerian terms this is an unreadiness-to-hand that creates tensions for the user in both assisting in understanding the local world, but also in fragmenting and deterritorialising at the same time. Berry explains, This is the phenomena of 'unreadiness-to-hand' which forces us to re-focus on the equipment, because it frustrates any activity temporarily [Blattner 2007: 58], that is that the situation requires deliberate attention... Conspicuousness, then, 'presents the available equipment as in a certain unavailability' [Heidegger 1977: 102-3], so that as Dreyfus [2001a: 71] explains, we are momentarily startled, and then shift to a new way of coping, but which, if help is

given quickly or the situation is resolved, then ‘transparent circumspective behaviour can be so quickly and easily restored that no new stance on the part of Dasein is required’ [Dreyfus 2001a: 72]. As Heidegger puts it, it requires ‘a more precise kind of circumspection, such as “inspecting”, checking up on what has been attained, [etc.]’ [Dreyfus 2001a: 70] (Berry 2011: 126).

Our worldliness, or understanding of the world in an environment infused with IoT, is somewhat different in character to the world of pre-digital or non-digital things. The radical alterity of the thing of the IoT means that we are never directly in touch with the functioning of the thing. Nevertheless, there can be a gathering of the elements of the fourfold that allows Dasein to dwell with this kind of thing, and a circumspection that is an aspect of Dasein’s care. The thing in the Internet of Things may be technological, but its essence need not lead to a technological revealing of world; it can “thing” just as a hammer, jug or any other simple thing does. As Evans (2015: 70-75) argues, the thinging of digital devices is contingent on not only the function of the thing but also the orientation of the user to that thing. The user (or mortal) must be comported towards the thing in a mood of circumspection that is characterised by a desire to understand the world. Without this element, Ereignis does not occur and the thing from the IoT will continue to function without revealing a local world. Thinging is not solely a property of the thing; thinging is an event and without the elements gathered (including the circumspect user) the 'Thing' of the IoT is only an opaque, code-infused object.

### 3 The Nest IoT Device

*“We are creating a home that takes care of you instead of the other way around”*  
François Girodolle, NEST

With the growing number of smart products available, solutions to unify these devices, and prices increasingly becoming more affordable to consumers, the connected home is quickly becoming a reality. But the full potential of the smart home is still to be realised. The latest push from IoT is the “thoughtful home” – a home that knows your daily routines, your wants and needs and adapts to your lifestyle. The Nest is an example of an IoT-based device. Using the Thread protocol as well as WiFi, Nest Weave creates a de facto mesh network between your devices that ensures devices throughout the house, regardless of how far they are from a router. Meanwhile, a Nest product—either the Nest Thermostat, Nest Protect, Nest Cam, or any combination of the three—operate as hubs of sorts to keep everything connected (Fig 1). In strict terms, this device would be an assemblage of things, as it is made up of more than one sensor; but just like a car is made up of more than one component, in the moment of usage and 'thinging' it would be considered through circumspection as a unitary 'thing'. Equipped with sensors and connected to the internet, the "Nest" can be controlled remotely via a mobile app and can track the energy use of a household over time. Both features combine to create opportunities for novel services and business models within an emerging ecosystem of new collaborators, e.g. one current campaign includes energy companies to reward "Nest" users when they switch off their air conditioning during peak times. From this perspective the "Nest" serves as an innovation platform, which brings multi-partners together to co-create and use valuable services.

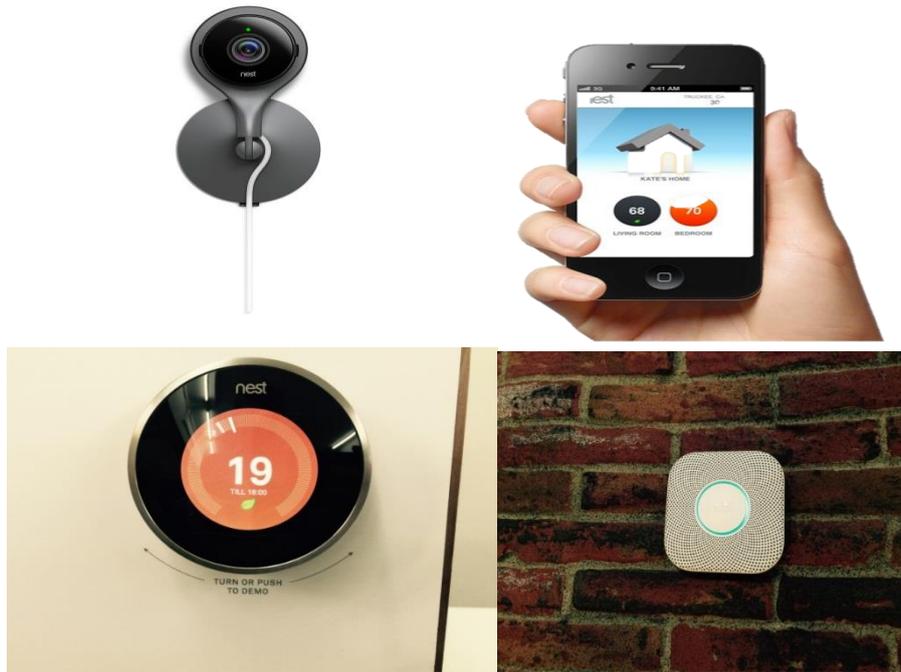


Figure 1: The Nest

Following the discussion of Heidegger's 'thing', it is reasonably straightforward to consider how the Nest gathers the fourfold in a way whereby a local world emerges from its 'thinging'.

Table 1: Heidegger's Fourfold and The Nest.

The Fourfold	The Nest
Earth	Embodied practices of use of the Nest, the haptic interface and the experience of the environment when used.
Sky	Information and data returned about place by the Nest.
Mortals	Users that takes the Nest into care.
Divinities	Feeling of place and placehood where the Nest is located ie. in the home.

The final element, *divinities*, is crucial in this analysis of the "Nest". The 'thinging' of the "Nest" is most circumspect in how it becomes part of the habitual, everyday experience of the home rather than an element that transforms the home into solely a data-producing environment to be utilised for efficiency and the production of data for the sake of data processing. Indeed, if the latter is the result of using the "Nest" then the device has acted in the way Heidegger theorised most technology as acting: transforming the home into a resource to be used (holding the home in 'standing reserve' [Heidegger, 1977: 4-5]). However, if the comportment of the user is towards integrating the device into the home and understanding the environment of the home better through use of the device, then 'thinging' is possible, and a understanding of the local world as it is brought forth by the thing can happen.

## 4 Conclusions

This paper explores the phenomenon of Internet of Things by applying concepts found in the philosophical works of Martin Heidegger and his reflections on the ‘The Thing’. He argued that distances were shrinking in the post-war world because of international travel and mass media. Heidegger linked this notion of ‘nearness’ to a notion of ‘thingness’ by suggesting how a thing related to the preconditions of its own existence. Naming those preconditions ‘the fourfold’, he argued that any thing ‘gathers’ this fourfold, helping individuals become closer to the world around them. Underpinning this perspective is a belief that science and technology, on their own, are inadequate to help individuals make sense of their daily experiences. Guided by Heidegger’s thinking, and using the IoT Nest device as a case-in-point, we advocate an approach to the future research of the nascent IoT phenomenon that would take account of (a) individuals’ sense of proximity and its influence on their engagement with the world around them, (b) how people conceive of the things around them, and (c) how they relate to the basic constituents of the world.

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