

The Internet of Things

in the eyes of the users

The Internet of Things needs innovative ways of interfacing with its users to make it clear that its power is **not in any of its single connections**, but in the totality of interconnections. Otherwise it is going to be very hard to create the **mass-market platform** the industry is hoping for.

AS WE STEER toward a future in which all our objects and environments are connected, we will eventually find ourselves living a technologist's dream, with everything part of the network. But how will people experience and interact with it? Will users see it as a logical step in the evolution of the World Wide Web, or is it going to be understood as something radically different from anything we have seen before?

In a modest way the Internet of Things is already here. During the second quarter of 2010, more than twice as many connected devices as people were added by carriers in the US.

Different kinds of gadgets and gizmos are gradually turning into hybrid devices that are services as much as they are physical objects. These days, the pads and pods – in all their different shapes and forms – are also expected to be the portals to an integrated ecosystem of services and applications. And the trend is spreading to devices such as television sets, hi-fi equipment, and even cars. Is this the beginning of a new era of innovative, intertwined, combined

products/systems/services that utilize the power of the networks?

Perhaps. But let's not kid ourselves. The technology industry, after all, is in the business of optimism. There is a solid belief that as it constantly demonstrates to customers how technologically and functionally state-of-the-art its products are, the value of their applications will be self-explanatory. When groundbreaking technology is developed, it's simply a question of creating enough hype and ensuring the packaging is right. That's bound to create mass demand, isn't it?

Sometimes the industry is utterly perplexed by the absence of consumer desire for seemingly "perfect" technology, even when everything has been done "right". There are many valuable and often quite amusing insights to be gained from the history of technological fiascos, but one of the main reasons that products flop is the industry's inability to imagine how they might fit into real life. There is a lesson to learn here: the industry needs to understand what it's like to be an end user, and the key to that understanding is empathy. ▶

► TECHNOLOGY ONLY PART OF THE EQUATION

The technology has to be shaped into something people understand, like, want and enjoy. This is why the industry must be able to foresee how its products are going to be understood, perceived and experienced.

And this is where many technology-heavy companies fail, because it is the point at which it is necessary to leave the rational technological logic behind. People already know quite a lot about the technologies they use, but our perceptions and behavior are very much decided by our emotions – which, in turn, are affected by many different things: for example, comprehension, physical and social context, trust or control.

These are the kinds of issues being addressed in the User Experience Lab at Ericsson Research. The cross-competence team conducts ethnographic studies, develops design concepts, facilitates ideation, makes prototypes and performs user tests.

Designing innovative service concepts and novel ways of interacting with technology is very much about understanding how users apply mental models to make sense of something. One important field related to the design of an Internet of Things is the study of how users make sense of, and experience environments of numerous networked devices.

In a study conducted by User Experience Lab focusing on usability issues in handling and managing several wireless networked devices, the participants were asked if they could explain what a wireless network was. This particular study was conducted in Sweden where, as in many other parts of the world, having a Wi-Fi network at home has become common. As expected, most of the participants confirmed that they knew what a wireless network was, in reality meaning that they knew what it was used for, or how to use it.

However, none of the participants actually explained their Wi-Fi networks by describing any of the characteristics of a network. Since people tend to describe something by referring to how they think it works in combination with how it is used, it was not surprising that in general, the participants' definition of a wireless network was that it is something (typically a laptop) that connects to the internet, for example. In other words, people casually define a wireless network as a replacement for a cable. This means that the word "network" has gained the somewhat simplified connotation of a series of a-to-b connections, rather than a web of numerous, simultaneous many-to-many interconnections, which is the actual nature of a network.

MAKING USERS AWARE

Their definition was not something that affected the participants' ability to use their Wi-Fi networks. But when they were presented with new concepts, where layers of device-independent multimedia services were introduced in the network, the mental model of a-to-b con-

nections became an obstacle that effectively meant the participants were unable to understand. The layer of services required the participants to be naturally aware of the interconnections in the network, an awareness they did not have because their conceptualization did not accommodate interconnections.

The participants were not by any means unintelligent, and many were extremely technology savvy. This simplified understanding of a network is reached through common sense, and is the way people normally figure things out. People understand a new thing by looking for a previously existing thing that is close enough in terms of usage, form and function to be seen as its predecessor.

For example, most people categorize today's advanced mobile device as a phone, and regard making voice calls as its obvious main function – even people who tend to use it almost exclusively for text messaging, playing games, accessing a variety of applications or browsing the web. That is how strong the mental connection is to its analog ancestor.

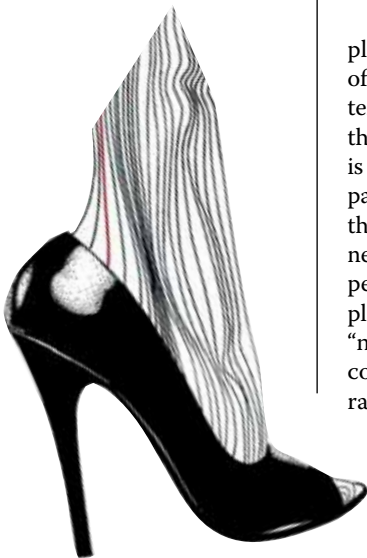
The same logic applies to people who view their wireless networks as a series of invisible cables. Before we had wires to connect things; now we use a Wi-Fi network. Language also reveals a lot about how people make sense of things, not to mention how the words reinforce the concepts they are used as descriptions for. Hence "wireless network" relies on the concept of "wire" to give an idea of what it is.

Looking ahead, if we keep in mind how analog ancestors and mental models affect people's understanding, then the term "Internet of Things" is clearly problematic. The words themselves force us to mentally connect it to what we know of the internet. We automatically interpret it to mean something like: "things with internet" and/or "internet with things in it." Since most people commonly use the terms World Wide Web and the internet interchangeably, the derived understanding of the "Internet of Things" will be something like "things with web pages, links, e-mail and Twitter accounts."

This description may fit many of the connected gadgets that we see today, but it gives no effective intuitive understanding of the implications of, and opportunities afforded by, a web of billions of connected physical/intangible, visible/invisible, always online and real-time interrelated devices, sensors, services, environments, places, objects and users.

WHY PERCEPTION MATTERS

What's the big deal, you may ask? Is it not so that simplicity is in fact a good thing when we talk about usability and user interaction? Well, yes and no. It depends. For the Wi-Fi networks in our homes today, the metaphor of invisible wires is perfectly adequate. But for a future scenario where we have billions of networked things, this simplified understanding becomes a limitation that has to be considered by anyone who wants



to design useful and usable systems and services for an Internet of Things.

Why? Because its true power is to be found in the core characteristics of the network as such, and the opportunities that these core characteristics enable are currently hidden in a blind spot created by the mental model and the analog ancestors. Users may think they understand what the Internet of Things is, but in fact, they will not be able to see its real potential.

And this is not only true for the individuals who are the so-called “users.” Businesses are people too in the end, and even professionals with expertise in infrastructure business models and network technologies apply the simplified mental model when they switch from thinking as professionals to thinking as users. It is not a contradiction to have one understanding when thinking about something as an abstract concept, and then to use the metaphors inherited from its analog ancestors when experiencing the concept as a user. People are perfectly capable of holding several different understandings of the same concept at the same time.

The point is that while the abstract understanding of a network helps engineers and software developers to create systems and technology, as soon as the same people start to think about real-world usage scenarios they fall back on the simplified mental model of a network. This makes it harder to communicate what the technology is capable of and limits people’s imagination; and as a result it may prevent innovation.

NEW MENTAL MODELS

This is why it is important to introduce new mental models. The Internet of Things needs a new interaction paradigm that removes the blind spot and makes it obvious and intuitive to anyone that its power is not in any of the single connections, but in the totality of interconnections. If these new models are not created, it is going to be very hard to make the billions of connected things into the mass-market platform that the industry hopes it will become.

One approach, of course, is to do nothing – to wait and see how people eventually make sense of things. Since users have clearly become familiar with concepts that were radically novel in their time – like the car, electricity and the internet – surely they are capable of coming up with a perfectly good common understanding of the Internet of Things, too.

Perhaps today’s mental limitations may not be a problem in the future, and the Internet of Things is probably not going to be ubiquitous for many years. A technological concept’s connection to the past will eventually wear out as new evolutionary branches are introduced and usage patterns move further away from the original functionality. In the case of the mobile phone, we may actually be seeing signs that the link to its analog ancestor is weakening, as new evolutionary offshoots of mobile devices are introduced.

But this is a slow process; one that often goes on for decades, sometimes centuries. Doing nothing may be the right approach only for those who are really patient.

Those of us who are not should do something to change people’s conceptualization. But what? The history of technology can supply a couple of other concepts that have gone through transformational stages in their evolution similar to what is being described here regarding the Internet of Things. The PC is a case in point. The PC concept evolved into a technological as well as a social revolution, not to mention a new global market. What really enabled the success of the PC concept was the insight that the key was a better user experience; the PC was initially too technical and needed to become more “human” if it was ever going to become a market success.

Apple introduced the graphical user interface and the mouse, which transformed the personal computer into something usable, understandable and eventually extremely popular. Its impact on society has indeed been profound.

Imagine therefore what it could mean if our physical world became a part of the internet. And think for a moment of today’s concept of an Internet of Things as at a stage equivalent to the first text-based interfaces for computers. Then imagine if we could do something to the Internet of Things similar to what the graphical user interface did to the PC.

And so, the cable is currently the mental model for a network and the World Wide Web is about to become the analog ancestor of the Internet of Things. But these metaphors are insufficient to explain the nature and opportunities of this technology evolution. This is bad, because if we think this way, as people are prone to do, the possibility of having more than 50 billion connected devices will be obscured by an insufficient mental model.

A new innovative and intuitive way of understanding the interconnections must be introduced. It would result in us taking giant steps toward an era of innovative, intertwined, combined mash-up products/systems/services that utilize the power of the networks – and then the Internet of Things may really become the global market predicted by the industry of optimism. ●

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