

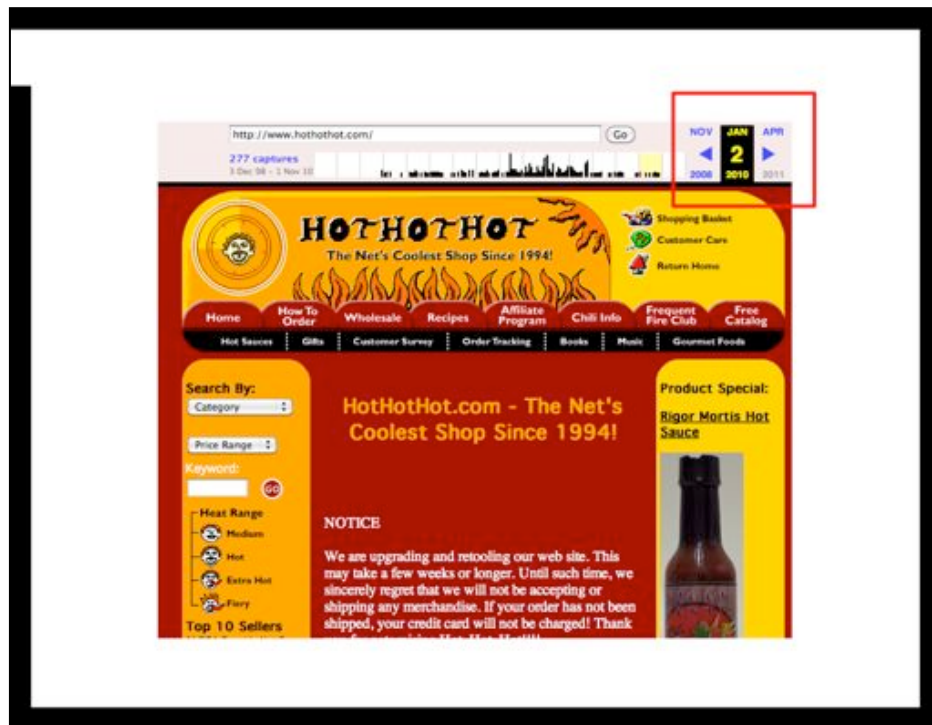
**THE INTERNET OF PEOPLE**  
INTEGRATING IOT  
TECHNOLOGIES IS NOT A  
TECHNICAL PROBLEM

**Mike Kuniavsky**  
Internet of Things Day  
Swedish Internet of Things Center,  
Stockholm  
February 9, 2012

Good morning. It's an honor to have been invited to this gathering. I have long been a fan of the work done by SICS and the Mobile Life center. Today I'm going to present my perspective on how the main challenge of meeting the big visions of Internet of Things will not be in on creating new infrastructure technologies, but in developing user-centered services, that the focus should not be on what digital things do, but how they can help people.



First, let me tell you a bit about my background. I'm a user experience designer. I was one of the first professional Web designers in 1993, where I was lucky enough to be present for the birth of such things as the online shopping cart and the search engine. This is the navigation for a hot sauce shopping site I designed in 1994.



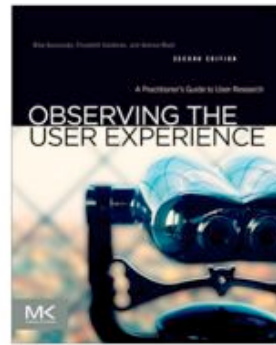
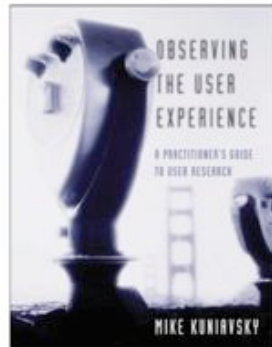
I'm proud of the fact that 16 years later they were still using the same visual identity. These were some of the oldest pixels on the Web.



Here's one of my UI designs for the advanced search for HotBot, an early search engine, from 1997. If you're wondering why Google's front page is so minimal, I think it was because we were doing this.



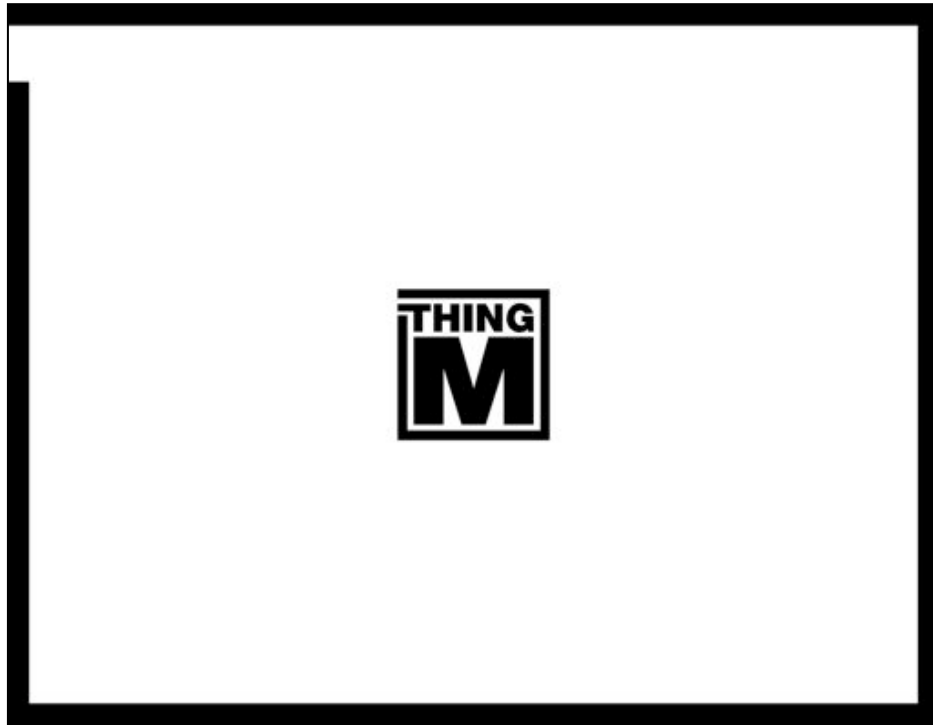
Since then I've consulted on the user experience design of dozens, maybe hundreds of web sites. Here's one for credit.com, who were fantastic clients a couple of years ago.



I sat out the first dotcom crash writing a book based on the work I had been doing. It's a cookbook of user research methods. It came out in 2003 and the second edition [CLICK] will come out this fall.

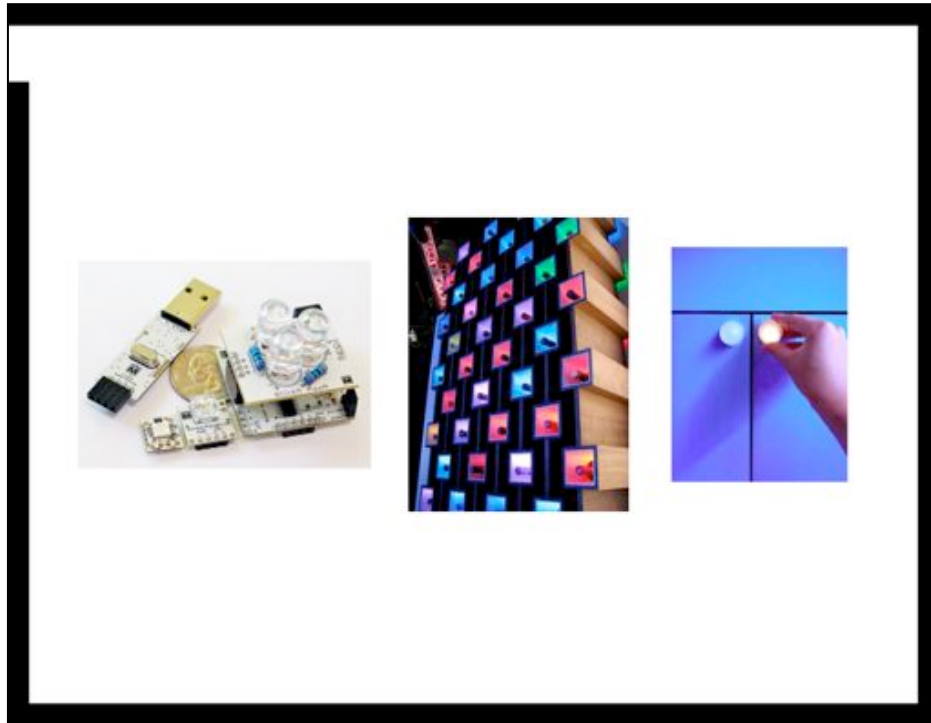


And 2001 I co-founded a design and consulting company called Adaptive Path.



I left the Web behind in 2004 and founded a company with Tod E. Kurt called ThingM in 2006.





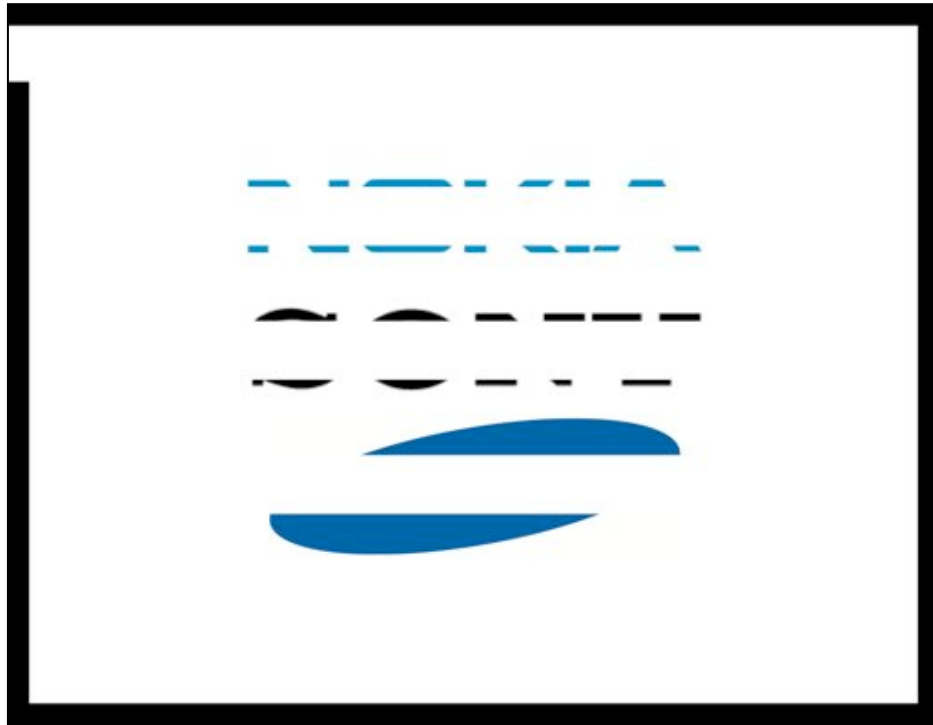
ThingM is a micro-OEM and an R&D lab. We design and manufacture a range of smart LEDs for architects, industrial designers and hackers. Our products appear on everything from flying robots to Lady Gaga's stage show. This is an RFID wine rack that we did about four years ago. The different light colors represent different facets of information that's pulled down from a cloud-based service, such as current market price. This is a capacitive sensing kitchen cabinet knob we did two years ago. It glows when you touch it to creates a little bit of magic in your everyday environment and was an exploration in making a digital product that would still be useful 20 years after it was made.



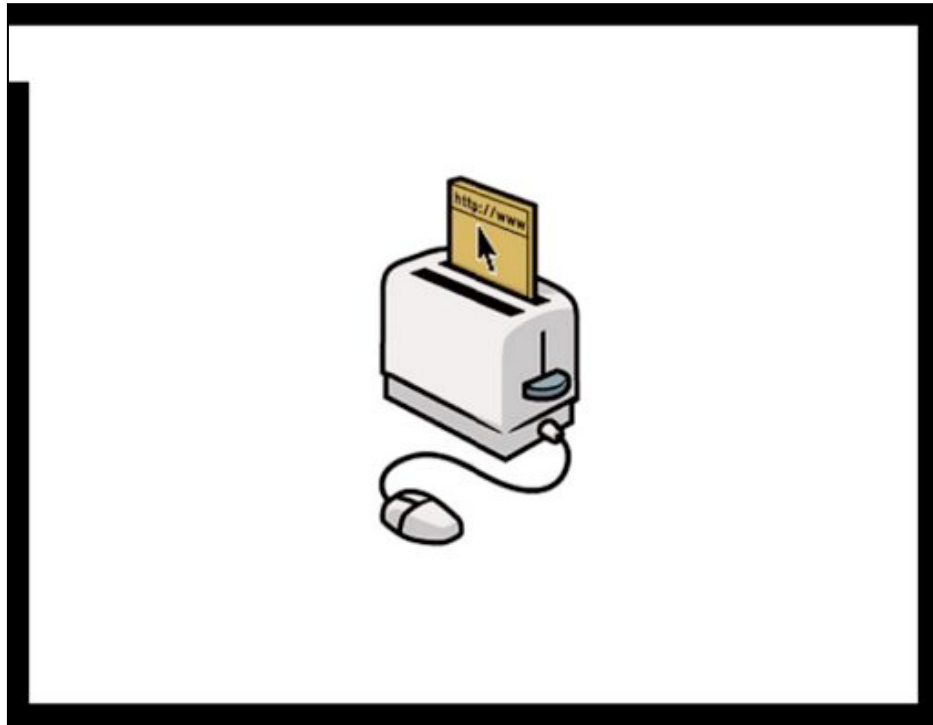
In 2010 I wrote a book on the user experience design of ubiquitous computing devices, which I define as things that do information processing and networking, but are not experienced as general purpose computing or communication devices.



However, ThingM and books are primarily side projects. My primary day job is as an innovation and user experience design consultant focusing on the design of digital consumer products. Here are some I've worked on for Yamaha, Whirlpool and Qualcomm.



The last couple of years my clients have been large consumer electronics companies and my focus has been on creating experiences that span multiple devices. I can't give you any details.



A lot of my projects broadly fall under the description of the Internet of Things, but that's a really challenging name to work with.

Talking about The Internet of Things is a hard because there are so many different definitions. This is Time Magazine's illustration of the Internet of Things for their "Best Inventions of 2008" edition. I love this illustration is because it makes no sense no matter how you think about it, which is actually quite an accurate representation of how confusing the many definitions of the Internet of Things are right now.

**DISTRIBUTED  
COMPUTATION +  
PERVASIVE NETWORKING +  
AUTOMATIC  
IDENTIFICATION + CHEAP =  
THE INTERNET OF THINGS**

Let me give you my definition, which is pretty broad. For me the Internet of Things is the combination of distributed information processing, pervasive wireless networking and automatic identification, deployed inexpensively and widely. The underlying technologies and the applications that are traditionally discussed don't matter much, because it is this combination of factors that deeply affects people and industries, and it does it by connecting people's immediate experiences to the power of digitally aggregated and analyzed information. In other words, the Internet to Things turns physical actions into knowledge in the cloud and knowledge in the cloud into physical action in a way that's never existed before.



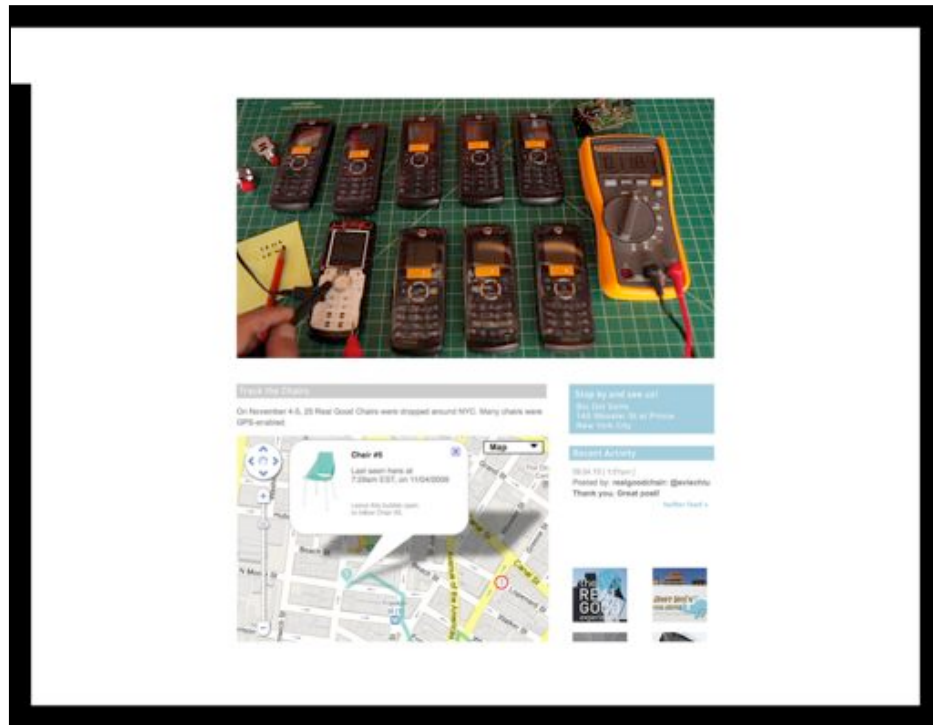
So, for example, I count the FedEx Sensaware smart tag and the Yottamark tracking system to be roughly identical. The Sensaware tag has a bunch of sensors, a GPS and the equivalent of a phone in it. It's used to track high value items, such as human organs, that need to be shipped under precisely maintained conditions. The Yottamark system uses stickers, readers and a wired network service to track things such as produce and car parts.

Technologically there's almost no overlap, but they both give people the ability to treat physical objects like they have been treating data packets. They bring the power and ideas of the internet to physical things.



I also count this to be a member of the Internet of Things. It's a cheap phone. It has all of the the core components of the Internet of Things and it creates many of the same social effects. People begin to use it in the same way.



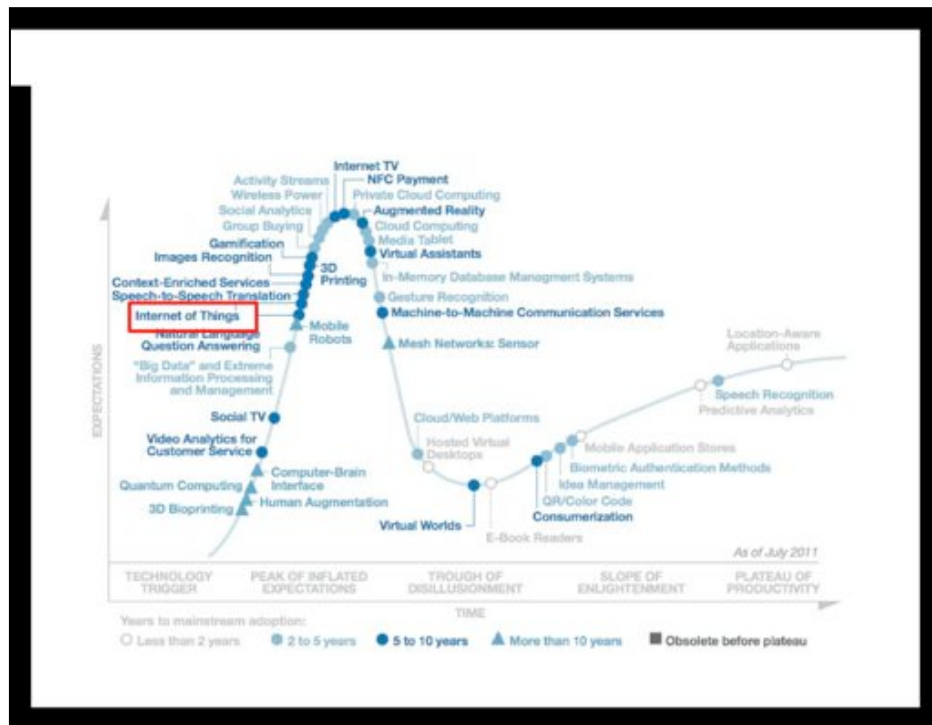


You can see this in how people are using hacked phones to do cheap Internet of Things prototyping.

Here's a project by Tellart, a Rhode Island design firm, that uses cheap phones to inexpensively add wireless tracking and identification capabilities to chairs. They did this with an advertising agency working for a furniture client. They strapped a GPS-enabled phone to the bottoms of chairs and distributed those chairs around Manhattan, leaving them on street corners to look like trash. People of course picked up the chairs, and the agency tracked those chairs around the city and found the people who had taken them. They then did an advertising campaign with those people, asking them why they had taken that specific chair. This is exactly the same kind of thing that the FedEx Sensaware tag is doing, but deployed by a bunch of designers for an ad campaign using technology so old that it was on phones that were ready to be thrown away.



Here's a project that Eric Paulos did with Intel research. They attached mobile phone-based air quality sensors to garbage trucks to create a daily updated air quality map of San Francisco. The core piece of technology is the mobile phone, which at the time was the cheapest Internet of Things platform.

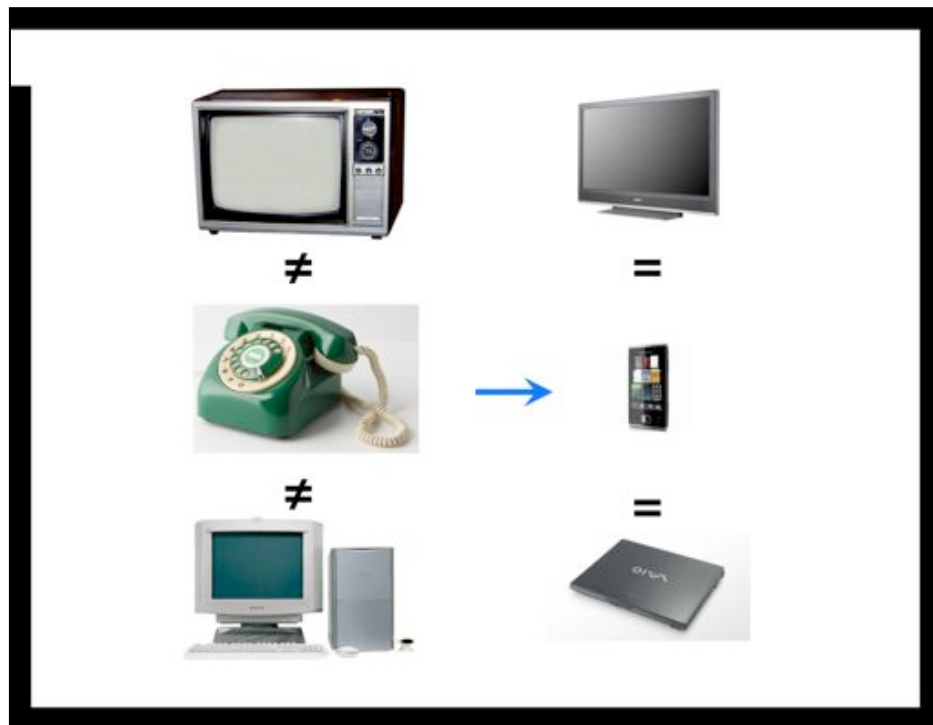


In other words, although it's discussed as an emerging technology, I believe that The Internet of Things is actually a combination of mature technologies, much more mature than people give it credit for. The reason it's climbing the Gartner Hype Cycle is because those mature technologies are now cheap, and the rise of smartphones has made people more aware what happens when you take a small bit of functionality, which is what an app is, and distribute it through the world. I believe that people are looking at apps and thinking to themselves "Why do I need that expensive phone, with all its capabilities, to do this one thing? Why can't I just take that app, pluck it off the screen, and put it into a dedicated piece of hardware that only does that one thing? These technologies are really cheap. I can do that."



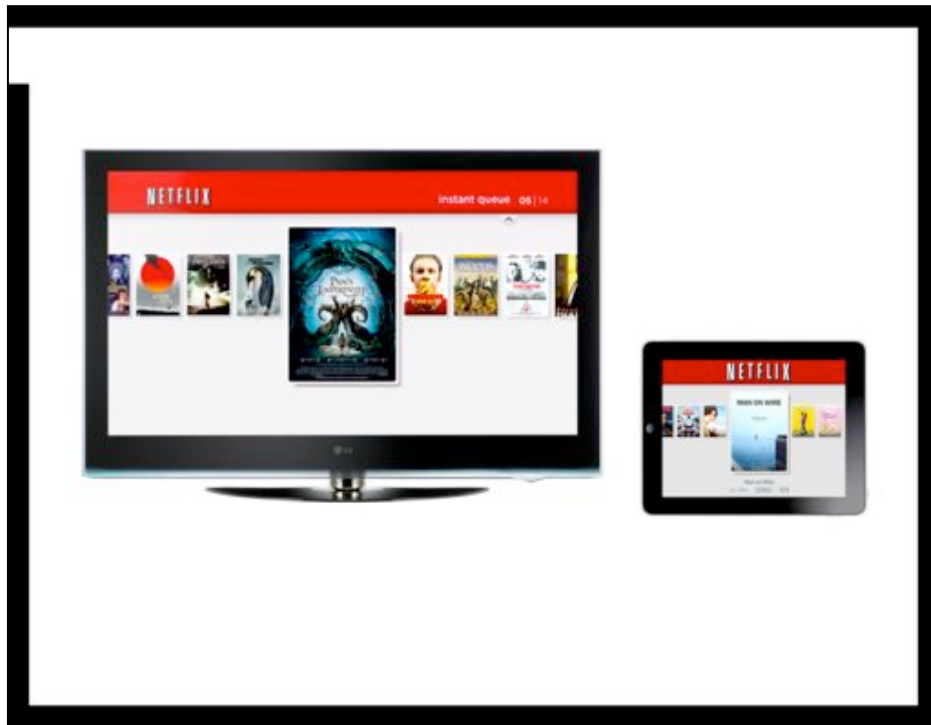
However, if you look at what applications are currently given as examples of the Internet of Things, you'll see that they're mostly top-down large-scale centralized infrastructural applications. Here's San Francisco's parking system. It uses sensors in the street to see what spaces cars are parked in. It can tell you where there are empty parking spots and can dispatch meter maids to write tickets more efficiently.

But these projects are not the ones that I believe will have the greatest impact on the world, nor where the greatest innovation will lie. I believe that the greatest Internet of Things innovation, and the deepest impact, will come from small, risky projects undertaken by entrepreneurs working with existing infrastructures.



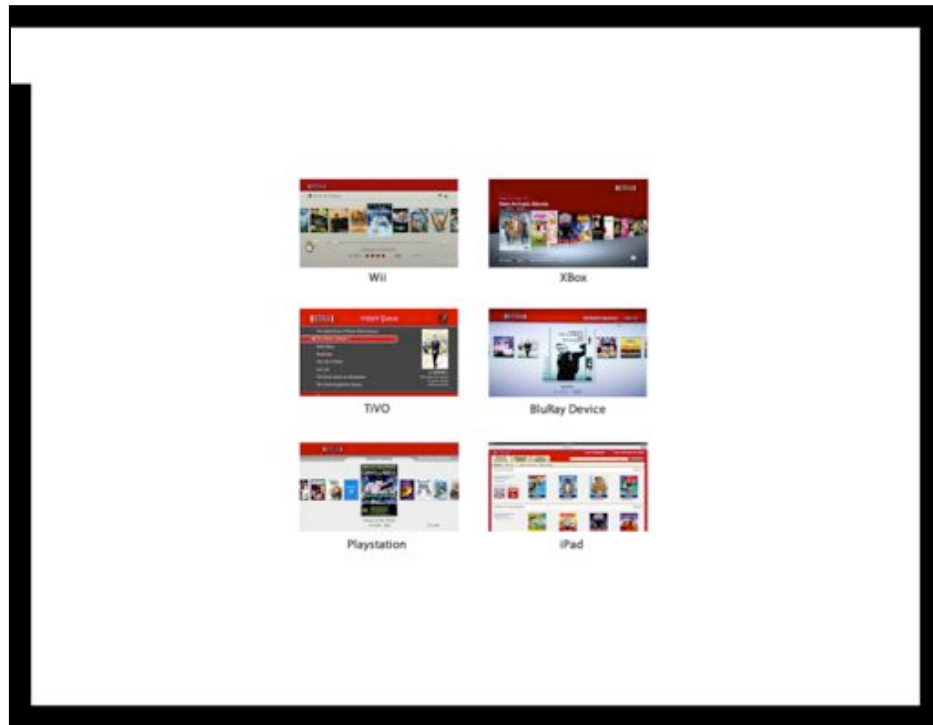
And I believe that this will happen as people bring online services into the physical world as specialized devices. Let me start by discussing a consumer electronics trend I've been working with for the last several years, which I believe points to a deep shift in how people think about products.

Over the last couple of years, there's been a collapse in device functionality. There is now little distinction between a phone, a tablet, a laptop and a smart TV, except for the size of the display. Anything can do anything, roughly speaking. This has been accompanied by a fall in profit on these devices.



Companies have recognized that this shift to increasingly generic devices has been accompanied by a shift in people's loyalty. People's associations are no longer with the device, but the service that the device delivers. Loyalty is not to the maker of the device, but to the services that device gives access to.

Let me give you an example. Netflix is a US movie rental and streaming service. To the Netflix customer, any device used to watch a movie on Netflix is just a hole in space to the Netflix service. It's a short-term manifestation of a single service. The value, the brand loyalty, and the focus is on the service, not the frame around it. Netflix works hard to reinforce this by creating a continuous experience across devices. You can pause a film you're watching on one device and unpause it on another.

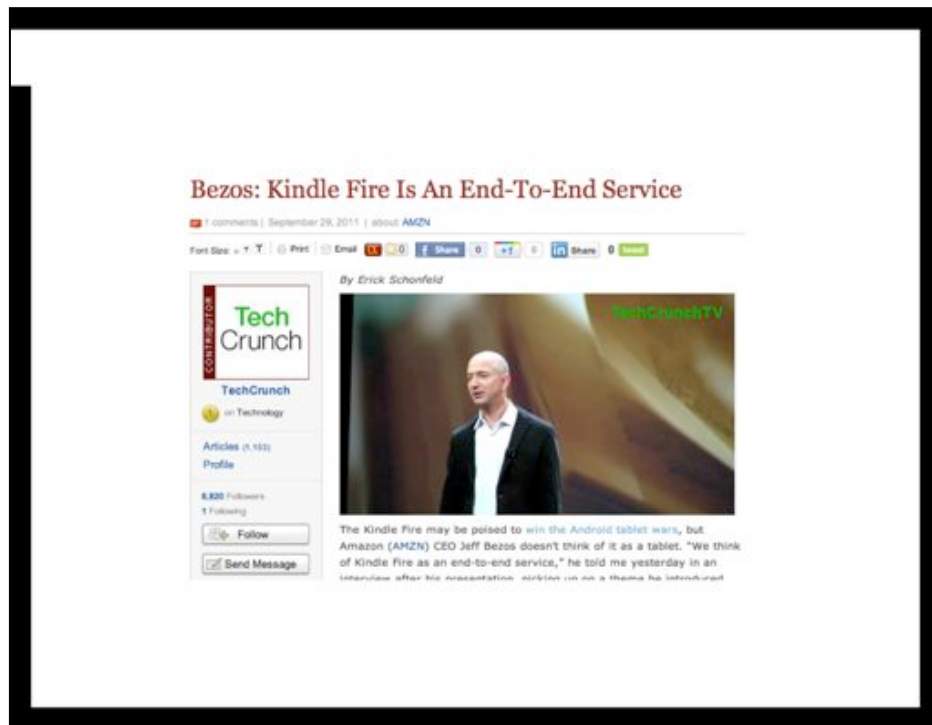


Netflix has worked very hard to make their service available on virtually every device that has a screen and a network connection. They use every device available to bring what is perceived as a single thing to every corner of a customer's life.



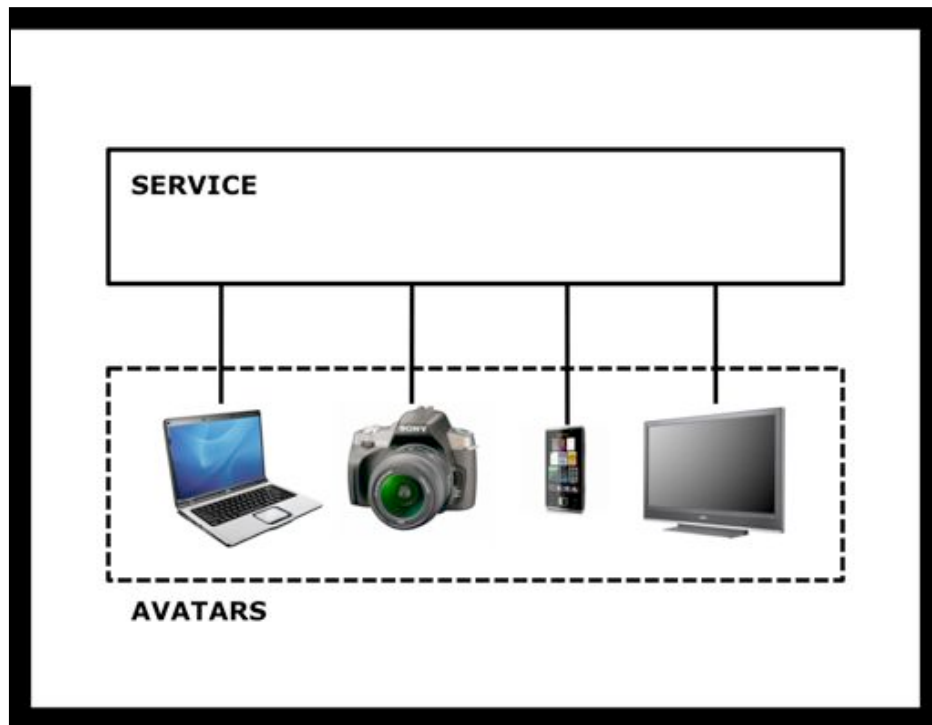
Another example is the Kindle. Here's a telling ad from Amazon for the Kindle. It's saying "Look, use whatever device you want. We don't care, as long you stay loyal to our service. You can buy our specialized devices, but you don't have to."





Jeff Bezos is now even referring to it in these terms.

The upshot is that this perspective reverses a traditional way of thinking about technology. Rather than thinking “Let’s build an infrastructure and then figure out how to use it. Now that we have it, what the applications of the technology?” this service-centric way of thinking about technology starts with a service, starts with concrete ways of creating value for people, and then uses every available technology to deliver that service. Of course Amazon started with the device, but they quickly realized that it was not the device where the impact and profit were.



As value shifts to services, devices, software applications and websites used to access those services — what I call the avatars of that service — simultaneously become more specialized and more secondary. A camera becomes a good way to take photos for Flickr, while a TV becomes a nice full-resolution Flickr display, and a phone becomes a convenient way to take your Flickr pictures on the road.

From this perspective, specialized hardware avatars begin to make more sense as people increasingly see “through” each device to the service it represents. Now they can recognize situations where a specialized device can provide significant value in using a service, while understanding that the service is not limited to that device.



I believe that this combination of factors will lead to an Internet of Things that are primarily services in the cloud, but services that have specialized hardware devices as one of their many avatars. This is already happening.

Let me show you a handful of examples that serve as early models. I'd like to start with these two, the Withings bathroom scale and the Nest thermostat. You've probably heard of both of these, but let me revisit them as avatars of Internet of Things services.



The Withings scale is an internet connected scale. At first it was kind of a gimmick. “You can tweet your weight to your friends!” was one of the ways it was originally pitched. That’s of course not particularly interesting, but that was not the purpose of the device. The device is the avatar to a health service that helped you track your weight. The scale is the way the service differentiates itself from other weight tracking services, but the value is not in the scale, but in the service, which is fully experienced using other avatars, such as the ones depicted on the right.



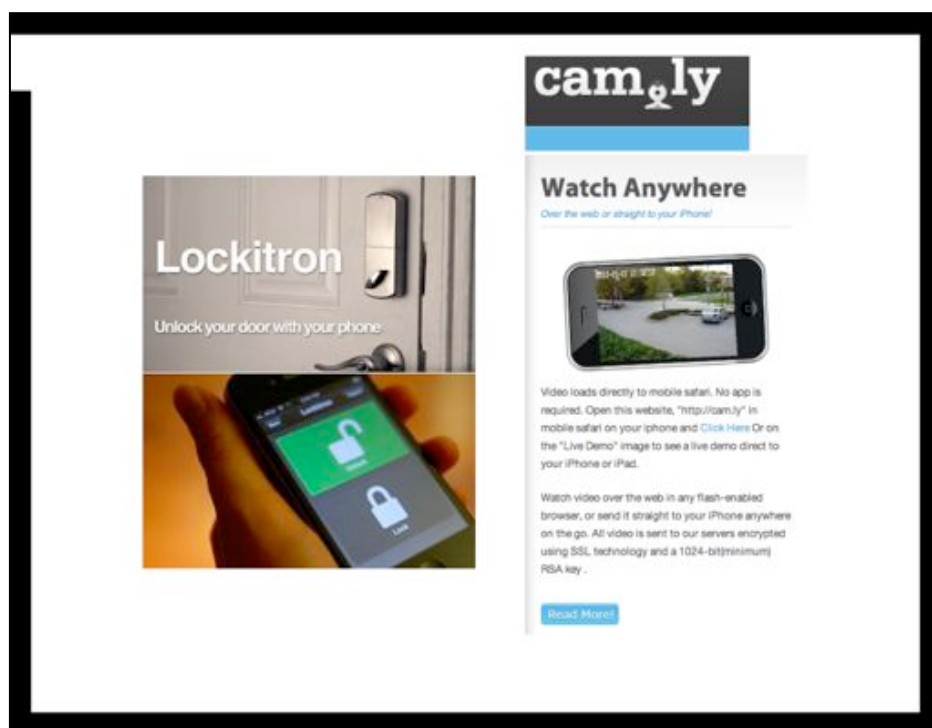
Withings has now expanded the service to include a blood pressure cuff. Again, the value is not in the devices, but in the knowledge that they create by collecting simple pieces of information and then providing users with the full power of cloud-based services to make use of that piece of information. Withings can keep adding avatars, new sensors and new ways to display the information the sensors collect, without fundamentally changing the promise of the service.



The Nest thermostat is a wireless thermostat that takes it one step further by closing the loop and allowing the online service to make changes in the world. The service uses information collected from the thermostat, the internet, and people's behavior to learn what the optimal temperature conditions are for an environment given how people use that environment. The sensor is pretty simple, but the service it provides access to is sophisticated. You can imagine them branching out into a wide variety of avatars for collecting information about your house and then acting on it in interesting ways, automatically moving money you save to special bank account when you behave in a particularly energy-saving way, but they begin with this very simple one that's almost a physical manifestation of an iPhone app. It even looks a bit like an app.

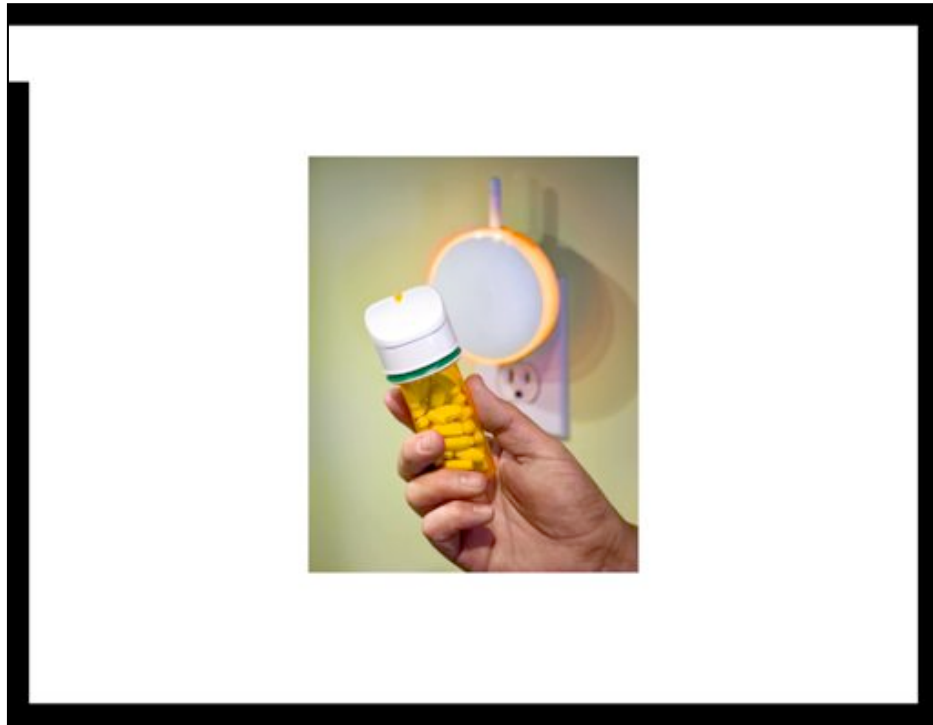


There is a whole class of such devices that are essentially projections of a cloud service through a limited functionality hardware product. Here are some that monitor personal health and fitness, there's the Fitbit pedometer, the Zeo sleep sensor and the Bodymedia sensor that can sense heart rate, skin temperature and other senses. These are of course sensor-based devices, but what they're selling is not the capabilities of the sensor, but of the cloud-based service the sensor connects to.



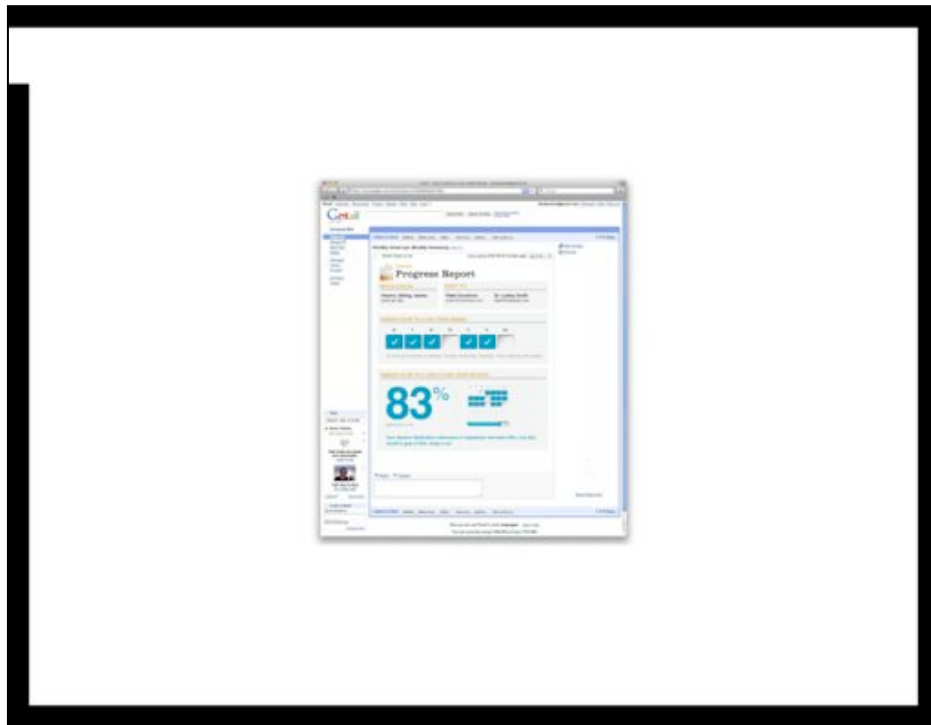
Here are a couple startups focused on the home security sector. Lockitron lets you control digital locks over the internet, so that you can, for example, use your phone to create a unique code for people who are renting your apartment that only opens it during certain times, or keep track of when a specific door has been opened. Cam.ly takes cheap internet security cameras and adds many of the features that a sophisticated surveillance system provide, such as the ability to review many days of video quickly, or to have it alert you when it notices movement in a specific area. They charge \$20 a month for this instead of hundreds of dollars. They can do this because most of the functionality is in the cloud.



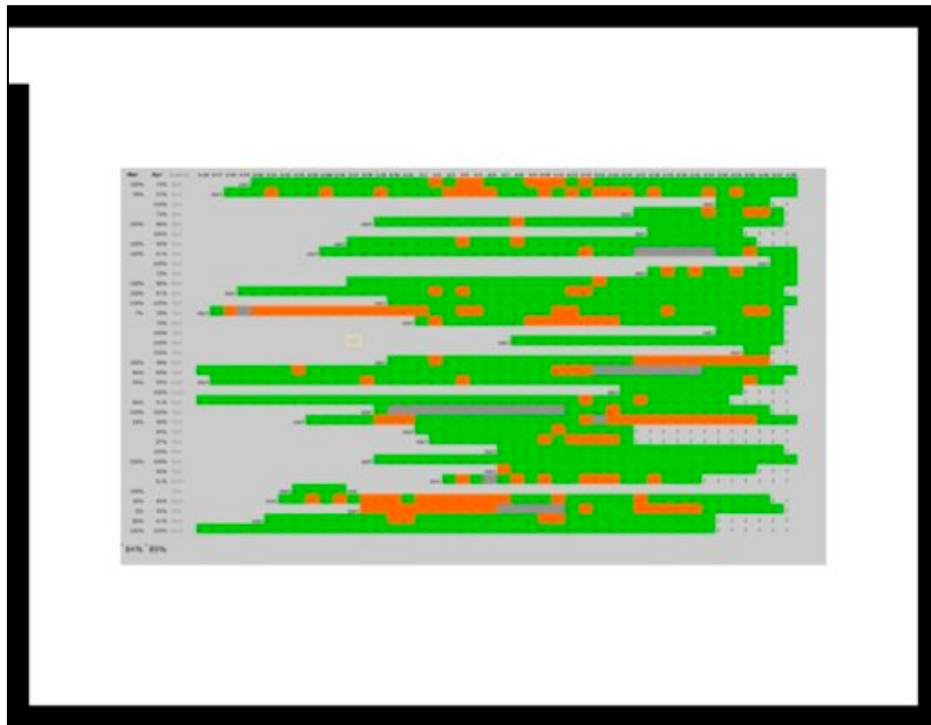


My favorite example is still Vitality's Glowcap, which I've been talking about for years. This is a wireless network-connected pill bottle that's an avatar to Vitality's service for increasing compliance to medicine prescriptions. When you close the cap, it sends a packet of information through a mobile phone-based base station to a central server and it starts counting down to when you next need to take your medicine. When it's time, it lights up the LED on the top of the bottle.

However, the real power is in the packet of data it sends. That packet opens a door to the full power of an Internet-based service. Now Vitality can create sophisticated experiences that transcend a single piece of software or a single device.

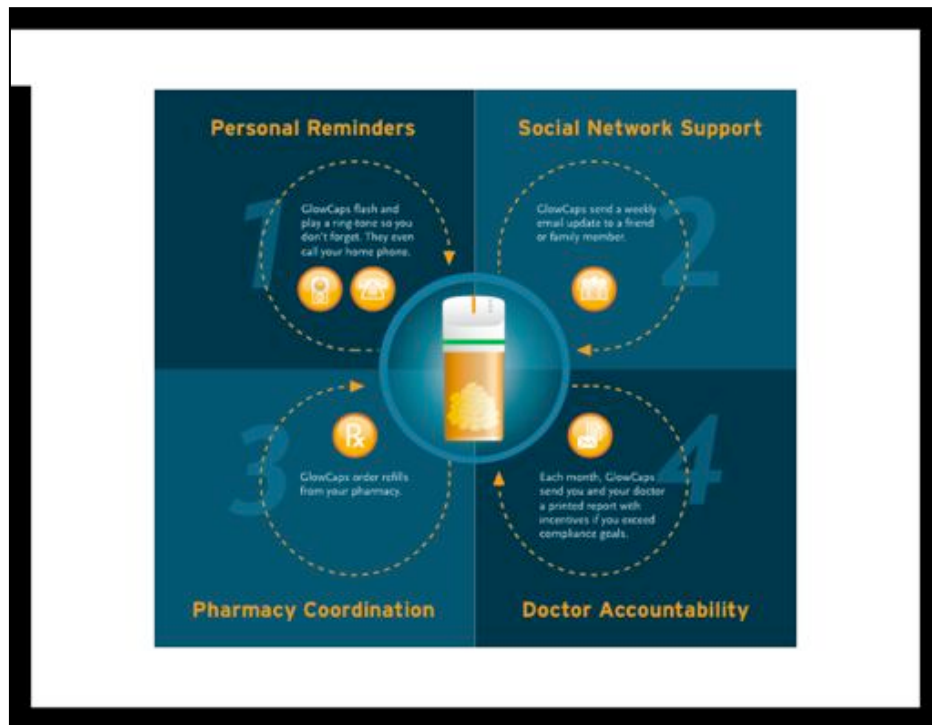


For example, another avatar of the Vitality service is an online progress report that can be used interactively or delivered by email. It's like Google Analytics for your medicine.



Health care practitioners get yet another avatar that gives them long-term and longitudinal analytics about compliance across medications and time.

To me, this kind of conversation between devices and net services is where the real power of The Internet of Things begins.



Vitality has developed a wide range of avatars for patients, patients families, health care practitioners and pharmacies. Each avatar looks different and has different functionality, but they're perceived, and designed as a single system.

The Vitality system is an Internet of Things service that doesn't use any esoteric or complex hardware or software. It takes a model of a service that's long been popular in websites, one that has multiple touchpoints and which uses digital representations of personal relationships to create significant social effects, except that in addition to emails and web sites and apps, it also uses a couple small pieces of hardware. It treats the hardware as a part of the service, as an extension of the service, but it begins with the service.



Creating services like this is becoming increasingly straightforward. The whole Web 2.0 change was at its heart about creating tools for rapidly building and iterating Web services. Ruby on Rails, server virtualization and web analytics technologies created an ecosystem where it's very easy to provision new services and to iterate based on data about how people use the service.. This infrastructure then became used by app developers who used it to create hundreds of thousands of apps in just a couple of years.

Now we're seeing technologies that make it similarly easy to add specialized hardware devices to services.

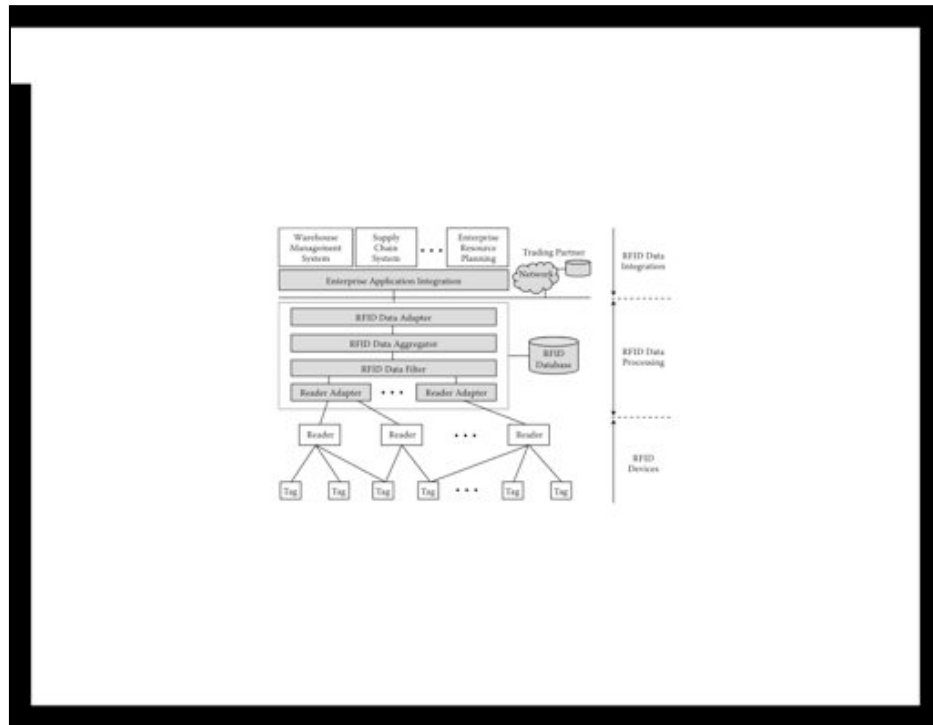
I grabbed this image from Arrayent, who is a company that makes a little hardware blob that connects virtually anything, in this case a smoke detector, to their cloud service. It can make any device look like a Web site, and there are other devices like it on the market.

Source: Arrayent



Services such as Pachube, sen.se, Thingspeak and Axeda are now serving a similar role by acting as data brokerages that make arbitrary, different devices act consistently. Pachube, for example, allows an arbitrary data stream from any net connected device to share that stream with any other device. The service will do the buffering, the protocol translation, the analytics, everything. It's a system that has its roots in Web protocols and mashups, now connected to hardware.

Connecting devices to the cloud allows for rapid iteration on features, since most of the functionality of those devices lies in the cloud.



The key to success with the IoT is to move beyond thinking of it as an infrastructural technology, such as this diagram of an RFID system, and to stop letting the name give you the wrong expectations for what it is. The name is a distraction. it implies a parallel universe that is as pervasive as the Internet, but different because it's about things. That gives the impression that projects that don't try to be as ambitious as the Internet somehow don't count. That misses a key point. The Internet of Things is ALREADY as pervasive as the Internet, because it IS the Internet. What's different is that it's now incredibly cheap to connect anything to the internet.

Image from "THE INTERNET OF THINGS: From RFID to the Next-Generation Pervasive Networked Systems" (Lu Yan et al, 2008)



The real challenge is not thinking about how we're going to create the Internet of Things. We need to think about how we're going to create the Google of Things, the Facebook of Things, the Foursquare of Things, the PayPal of Things, the Farmville of Things. It's not about the infrastructure, it's about the applications, and the applications are about people.

Scandinavia, and especially Sweden, has led the world in humanizing digital technology for decades. The work at SICS and Mobile Life has been doing has been pushing the boundaries of understanding people and adapting technologies to their needs and desires. The rise of the Internet of Things is a fantastic opportunity for Sweden and I'm very excited to see what you'll produce, because I'm sure it'll be amazing.





Thank you.