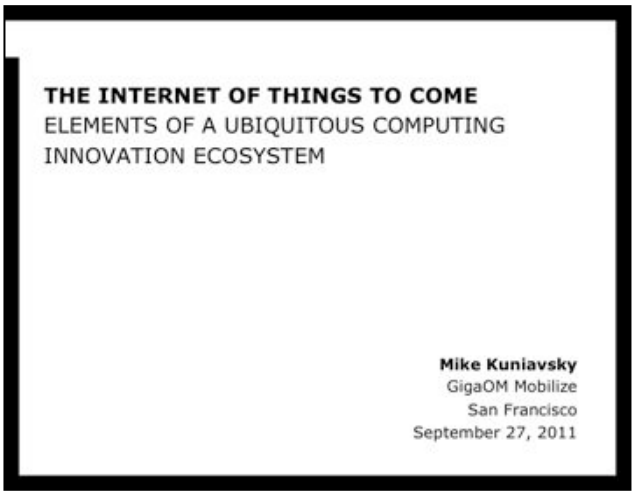
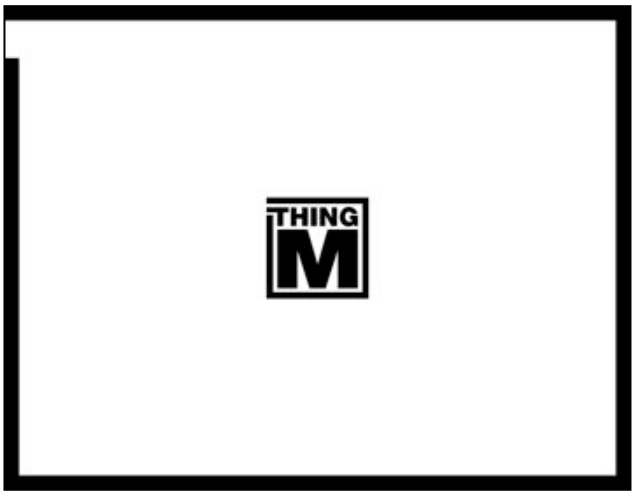


Good morning. Thank you for inviting me. It's an honor to be back. Today I'm going to be talking about the Internet of Things. Or, more specifically, how I believe that the landscape in which we create ubiquitous computing devices, such as the things that we call The Internet of Things, is about to fundamentally change.

First, let me tell you a bit about myself. I'm a user experience designer. I was one of the first professional Web designers in 1993. I've worked on the design of hundreds of web sites and many digital consumer products. I also regularly work with companies to help them create more user centered design cultures so they can make better products themselves.

I sat out the first dotcom crash distilling my experience into a cookbook of user research methods.

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

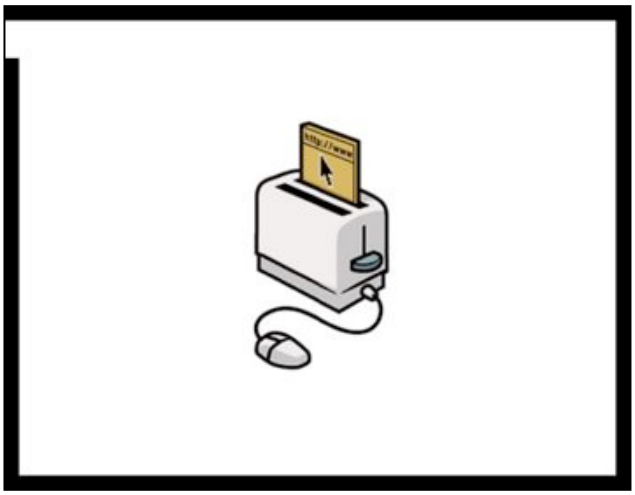


…and three years later I left it, and I left the Web altogether, to found a company with Tod E. Kurt called ThingM in 2006.

We weren't sure what we were going to be but it's turned out that we're a micro-OEM. We design and manufactures a range of smart LEDs for architects, industrial designers and hackers.

Last year my book on ubiquitous computing user experience design was published. It's called "Smart Things" and it's published by Morgan Kaufmann.

I also organize an annual summit of people developing hardware design tools for non-engineers. It's called Sketching in Hardware and it's this event that's probably most influenced the talk I'm going to give today.



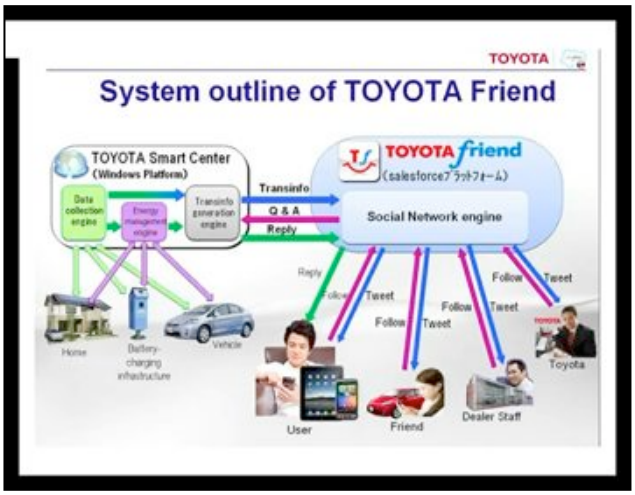
Talking about The Internet of Things is a challenge because there are so many different definitions. This is Time Magazine's illustration of the Internet of Things for their "Best Inventions of 2008" edition. I love this illustration is because it makes no sense no matter how you think about it, which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

Gartner has put it on their hype cycle, which means that all kinds of people are describing what they're doing as The Internet of Things, regardless of what they're actually doing.

I can't describe to you what the Internet of Things is, or is going to be. What I can do is tell what components I think are going to be in it, and how I think it's going to come about.

Its components will likely include digital identification through RFIDs or other technologies. These can, for example, tell you where your food was grown…

Source: Yottamark



It will almost certainly include pervasive networking that's used to collect telemetry generated by a wide variety of devices and then store and process it in the cloud. This will, for example, allows your car to be continuously embedded in both Toyota's corporate network and your social network…

It will also include embedded sensing in everyday objects that connects them to the cloud. This is Green Goose's sensor platform. They're based here in San Francisco and they put a sensor, a processor, a battery and a wireless communication chip into a puffy sticker that you can put on anything.

Combining these components into services will challenge existing industries. Car sharing, for example, is so heavily dependent on Internet of Things technologies it's hard to imagine it working otherwise.

The Internet of Things will then likely revolutionize infrastructures such as meter reading and parking collection, changing how we relate to our world on the scale of cities.

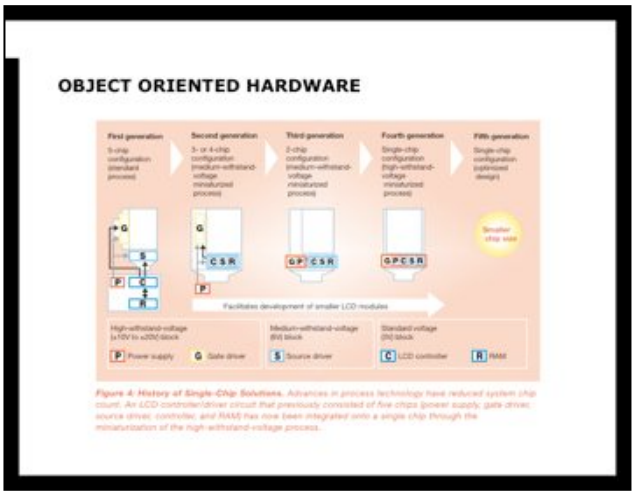
These are undeniably all pieces of the Internet of Things elephant…

The problem is that we're still pretty blind about what the elephant really looks like.

We're about to find out a lot more. There are a number of pieces that have recently begun to fall into place which I believe will create an ecosystem for the rapid development of Internet of Things products, technologies and companies, and that's what I'd like to talk about today.

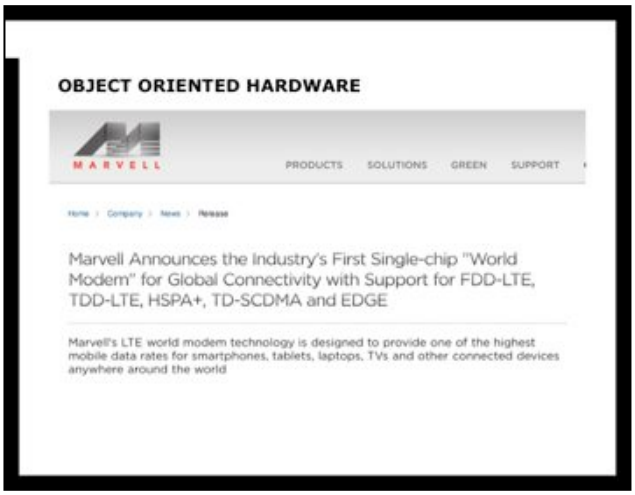
Source: Banksy's elephant.

Here are the six things I think make up this ecosystem.



I'm going to start with the nerdiest stuff first. Semiconductor manufacturers are putting increasingly more functionality on chips. Things that used to take five chips, as this diagram from Renesas Electronics shows, can now be done on one chip. This has all kinds of benefits from an assembly standpoint, but it also has an additional benefit. It creates an abstraction layer around a unit of functionality, in this case an LCD driver, to creates a single building block that's meaningful in human terms, rather than just electronic terms.

This is the start of object-oriented hardware. Each block is an atom of functionality that communicates with other blocks over a local network.



One block can do all of the work to connect to any phone network in the world.

Another is a complete GPS system.

Yet another is a multiaxis accelerometer that does the necessary math to clean up the signal.

This abstraction of knowledge into silicon means that rather than starting from basic principles of electronics, designers can focus on what they're trying to create, rather than which capacitor to use or how to tell the signal from the noise.

Assembling electronics has gotten very cheap. It's not just that it's cheap to ship stuff to Asian factories, but it's gotten surprisingly inexpensive to assemble hardware in medium sized runs yourself. Not ten units, which you can do by hand, and not a million, which requires a serious setup, but, say 1,000, or 5,000. This puts the idea of making small run electronics into cottage industry magnitude and brings it back closer to the hands of designers.

This is one of Sparkfun Electronics pick and place machines.

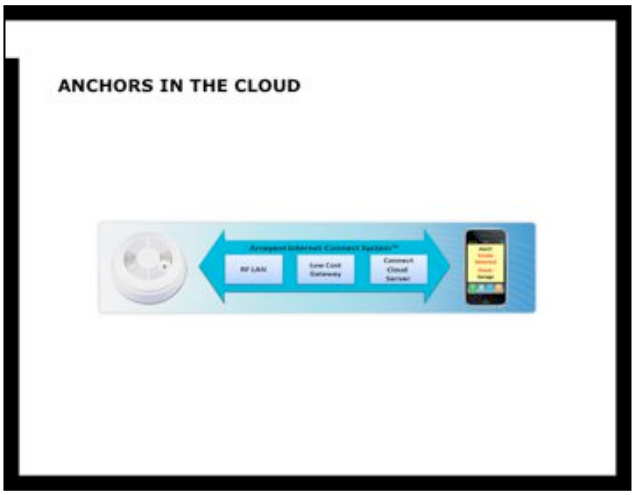
Source: Sparkfun

This is Adafruit's, who work out of a loft in New York.

Source: Adafruit

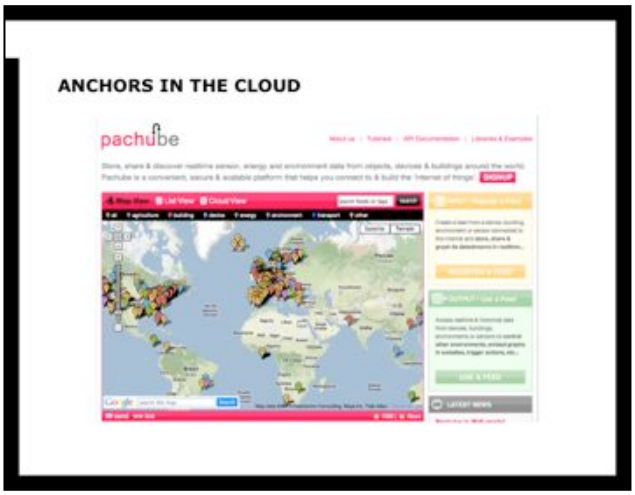
This is DIYDrones' the manufacturing company Chris Anderson of Wired Magazine runs in his space time. These are small companies that are nevertheless big enough that they decided to make their own electronics, because it's now a reasonable business decision.

Source: Chris Anderson, DIYDrones

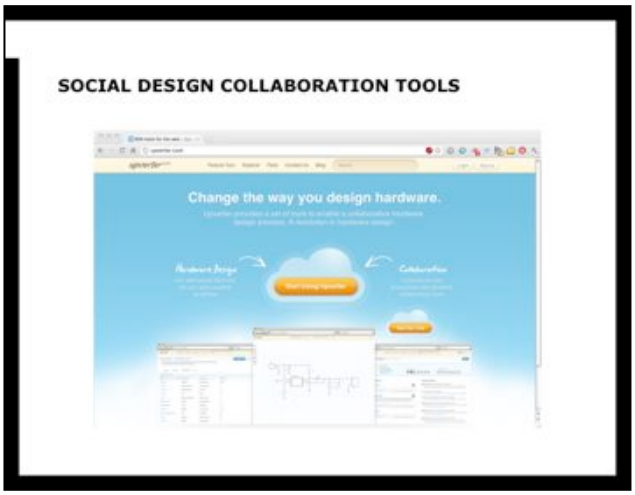


After twenty years of the Web, there's a lot of familiarity with it, and each new generation of designers and developers is more immersed in Web-like ideas. They increasingly think of digital technology as inherently anchored to the cloud and intuitively understand the possibilities that networked connections provide. There are embedded hardware products, hardware objects, that will do all of the provisioning of a service in the cloud once a connection is made. 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.

Source: Arrayent

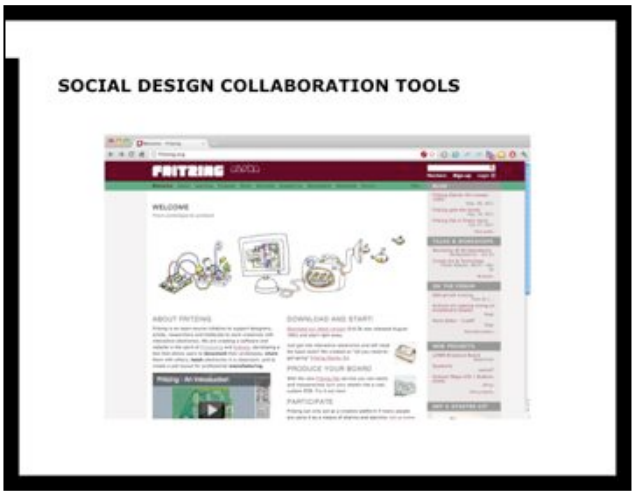


Moreover, there are now services such as Pachube, which was recently acquired, that allow an arbitrary data stream from any net connected device to share that stream with any other device. Pachube will do the buffering, the protocol translation, the analytics, everything. One device publishes an output stream, another device then subscribes to it it. It's a system that has its roots in Web mashups, now mapped to hardware



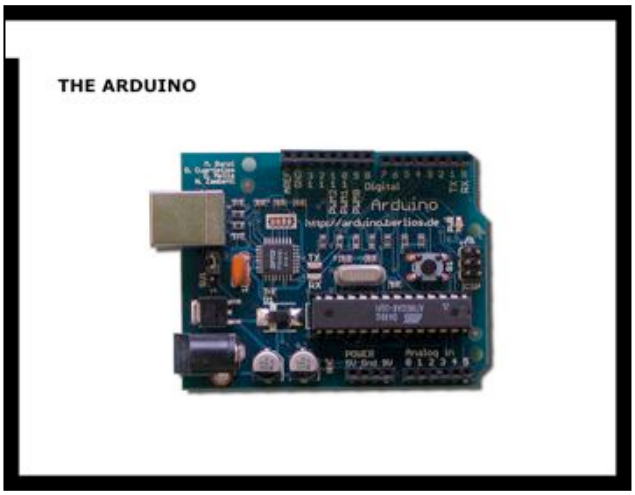
One of the most exciting changes is the movement of hardware development tools online. Hardware development used to be a solitary activity done in a lab with an oscilloscope and a soldering iron. Now it's becoming increasingly a social activity thanks to a new generation of online tools.

Upverter, a Y Combinator-funded startup that just launched their beta, is a product that integrates electronic design with social collaboration. It's like SourceForge, or GitHub for hardware.

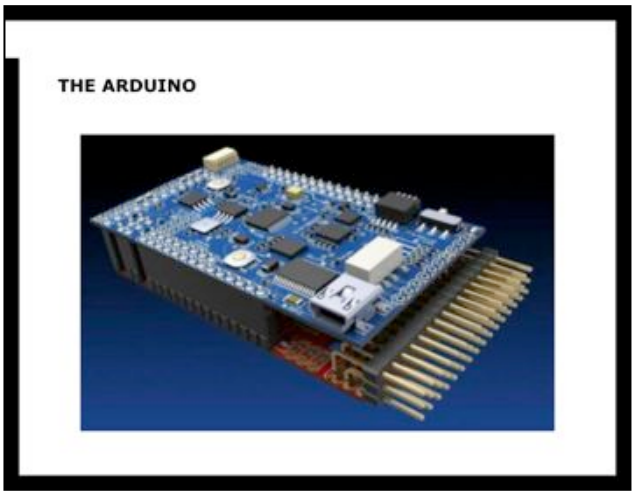


This is Fritzing, a open source project for online social hardware design. They will even print the circuit board for you and mail it to you.

Once you have social collaboration and the publishing and subscription of designs, schematics and code, you have the equivalent of View Source for hardware design. That, in turn, means that designers no longer have to start from scratch or from electronic textbooks or worry about asking noob questions on discussion boards. It's a model taken directly from how the Web grew.



The Arduino platform is probably the most mature and successful product to have come out of this type of collaborative technology environment.

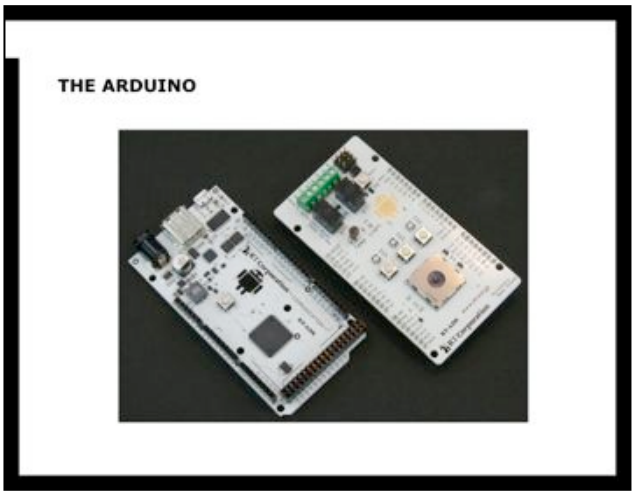


It has become the reference platform that people extend to accomplish specific things. Here's the Ardupilot drone controller from the DIYDrones folks.

Source: DIYDrones

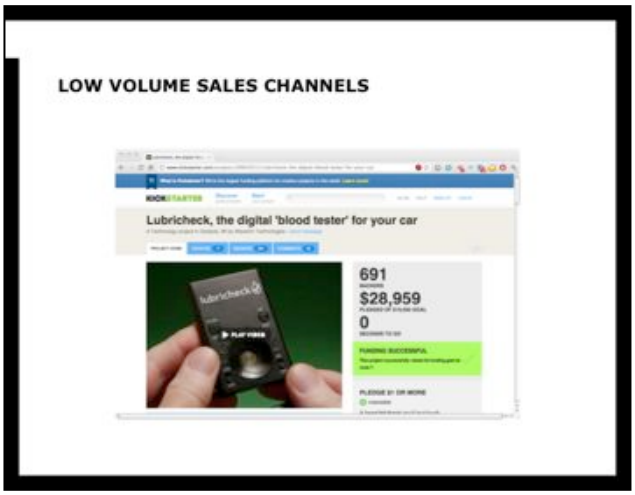
Here's one from All Power Labs that's used for precisely controlling an alternative energy gasifier unit.

Source: AllPower Labs



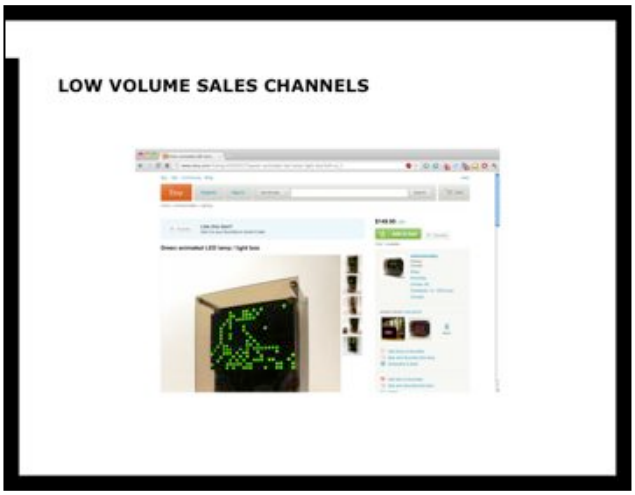
Here's Google's Open Accessory development platform. It's also based on the Arduino.

There were microcontroller platforms before, but the Arduino's popularity and flexibility makes it the Linux of Internet of Things hardware. It is not the killer app, but it forms the bedrock on which applications are built.



The final component of the ecosystem is probably the most important and least developed. It's a marketing and distribution mechanism that allows people to sell hardware in low volumes so that they can gauge interest and generate operating income.

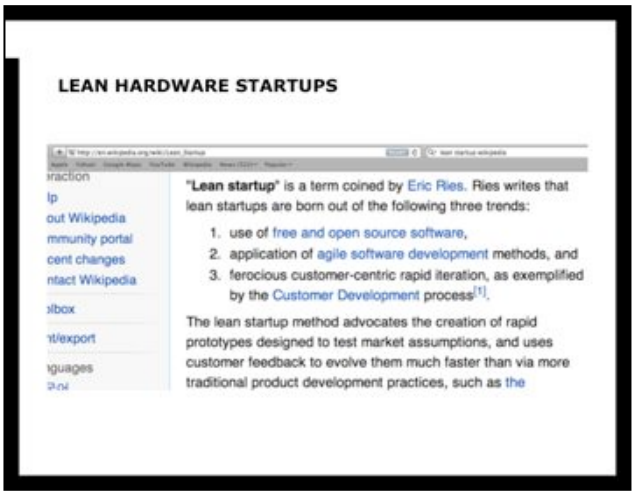
Kickstarter, in this instance, acts like a group buying site for products that don't exist yet, giving developers feedback about the popularity of their idea and teaching them how to position it for a market before they've made a single product.



Etsy allows very small run electronic products.

Even fab.com, which sells limited edition high design products like rugs and backpacks sells low run electronics.

These channels are immature, but they're becoming increasingly popular. In effect, they're doing an end run around the traditional consumer electronic ecosystem to address the long tail of electronics buyers. That also happens to be where much of the greatest innovation happens.



We've already seen such a combination of inexpensive infrastructure technologies coupled with online collaboration systems and a deployment and distribution mechanism that allows for rapid iteration with low overhead.

It's the core of the Lean Startup philosophy that's proven so successful in creating a bunch of new companies and services. If we look at Eric Ries' definition of what makes a lean startup, we can see all the pieces in this new ecosystem.

The tools are free and open. The costs for testing and assembly are low.

Object oriented hardware and social tools enable rapid iterative development, while cloud computing allows for rapid deployment of associated services.

Although they're immature, we're getting increasingly more low volume sales channels to test out ideas. I've singled out Kickstarter because in addition to sales, it provides feedback even before there are any sales, which is even more in line with the lean startup philosophy.

In the end what I am describing here is not the Internet of Things, or ubiquitous computing, but it is the innovation ecosystem that will lead to the Internet of Things.


SMART THINGS
Ubiquitous Computing User Experience Design
MIKE KUNIAVSKY
THING
M
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Thank you.