Mashups with atoms

Ubiquitous computing and Web 2.0

**Mike Kuniavsky**
Web 2.0 Expo
April 3, 2009

Good afternoon.

I'm a user experience researcher and designer. I spend much of my time thinking about how technologies and people affect each other from social, economic, historical and technological perspectives, and how the technological side of that relationship can be made better, or at least more interesting, for the human side of it.

Photo CC by Cocoarmani. Found on Flickr.
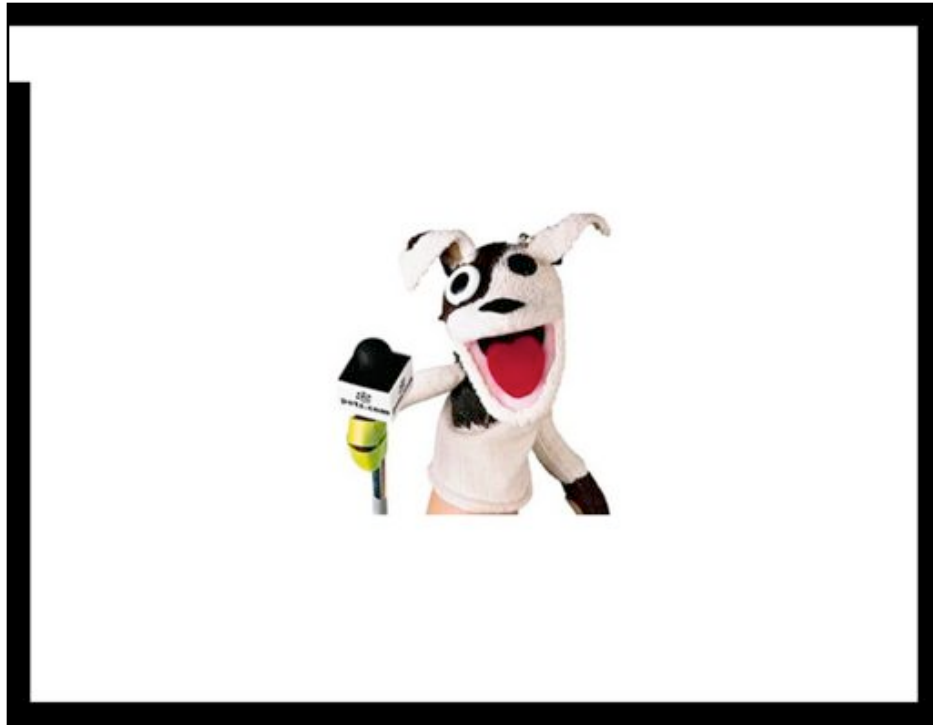
I spent a little more than 10 years doing design and research for the web. I worked with many dotcoms, some famous, some infamous.

OBSERVING THE USER EXPERIENCE

A PRACTITIONER'S GUIDE TO USER RESEARCH

MIKE KUNIAVSKY
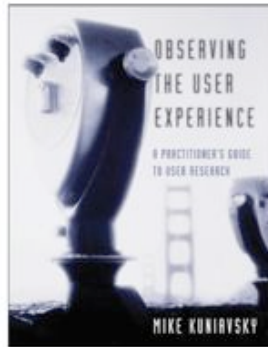
I sat out the first dotcom crash writing a book based on the work I had been doing. It's a cookbook of user research methods.

adaptive **path**

In 2001 I co-founded a design and consulting company called Adaptive Path. Things went very well, but I was interested in other ways that technology was changing society.

So I founded a company with Tod E. Kurt called ThingM to pursue these ideas commercially three years ago. We're a ubiquitous computing consumer electronics company, which sounds fancy, but we're pretty small. We design, manufacture and sell ubicomp hardware.
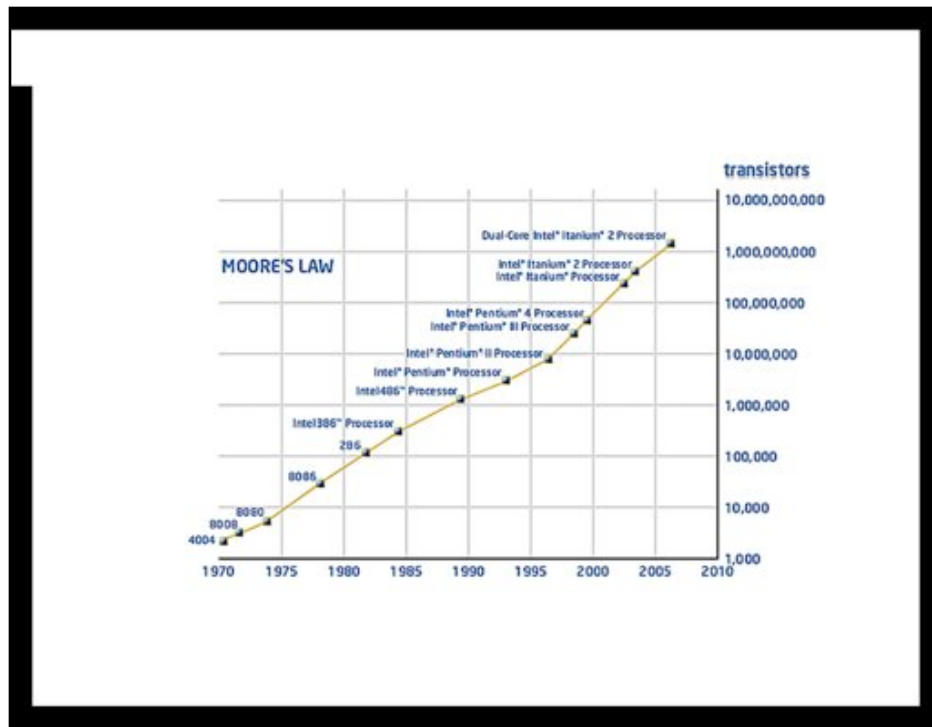
Today I'd like to start with Moore's Law. Typically, this graph is read as a trend representing how computers are getting more powerful, but it also represents a trend that shows how technology is getting smaller and cheaper.

If we look at the middle of this chart we see the Intel 486. The 486 correspond roughly to the beginning of the modern computer: one that has a graphical user interface, a multitasking operating system and is connected to the Internet. It's a very powerful device.

1989: $1500*
33MHz, 20MIPS

2008: $0.50
20MHz, 20MIPS

* CPI Adjusted to 2009, original price: $900

At its introduction it cost about $1500 in today's dollars just for that chip. Today you can get roughly that same processing power for about $0.50 in a microcontroller.

Because of this trend, I think that in the last couple of years we crossed a tipping point where embedding information processing into everyday objects to create novel behavior has gained significant competitive advantage and customer acceptance. We can now think of information processing as a kind of material with which to design everyday things, instead of as an expensive, precious thing.

The toy industry, because it is so competitive, leads in this field. Using embedded computers they can cheaply create behaviors in toys that are worth much more than the cost of the hardware and engineering. When people buy a Tickle Me Elmo, for example, buyers are paying for the behavior, not the furry red doll.

Simultaneously with this tipping point, we had another: Web 2.0. One of the cornerstones of Web 2.0 is open APIs that let software exchange small pieces of information so that complex experiences can be created out of simple components. This is the mashup.

When you expose an open API in a dedicated tool, you get a widget. It's a little blob of functionality, whether it's on your desktop, your phone or your Chumby. The growth of widgets parallels that of Web 2.0. Widgets represent a fundamentally different software development philosophy from the design of traditional software, which was based on large, monolithic platforms. That philosophy seems to be going away, as evidenced by the iPhone App Store, Blackberry's App Store or how most of Facebook's functionality is created.
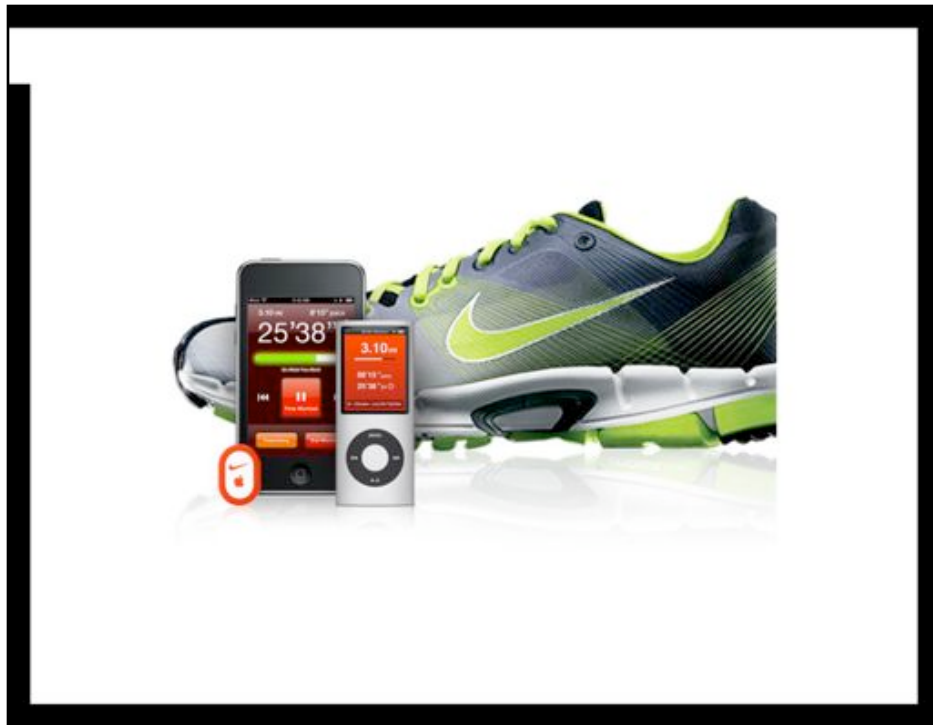
Moreover, they are now escaping from the bounds of general-purpose computing devices.

MP3 players, personal video recorders, digital TVs, GPS devices, all kind of budded off of general purpose computers to become things in their own right. Other products, meanwhile, move in the other direction. Everyday things like shoes are augmented by technology, and as they do that, they become widgets on the screens of other computers.

If we add up the idea of mashups, widgets and the capabilities of cheap embedded hardware, we create a fantastic new set of opportunities for new tools.

This is Health Hero's Health Buddy system, which helps people manage chronic disorders by asking them questions and giving them advice about their condition, while correlating their answers with their long-term prognoses and relaying that information to their doctor. It's a hardware-software-network mashup.
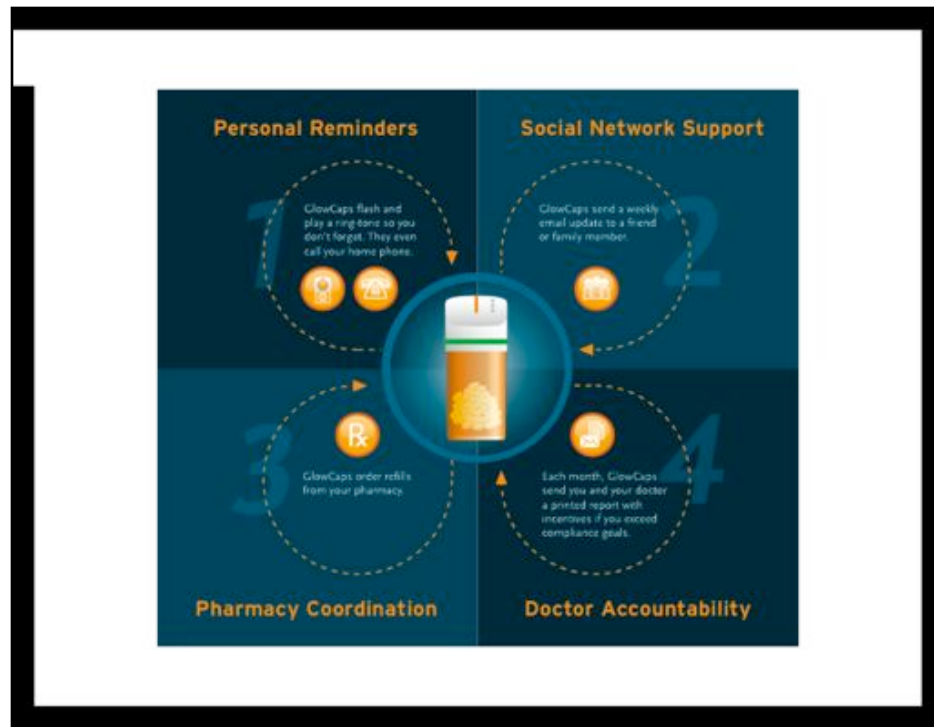
This is a Glowcap, which is a wireless network-connected pill bottle that's reminds you to take your medicine and tracks your compliance. When you close the cap, it sends a packet of information to a central server to say that you took your medicine. Meanwhile, it starts counting down to when you next need to take your medicine, when it lights up the LED on the top of the bottle. It's a simple augmentation that adds a tiny bit of hardware to an everyday object, but that small change—that thin technical edge—carries with it a huge wedge that blows the potential inherent in the object wide open. The pill bottle becomes a door into a profound behavioral change.

This is one of my favorite new ubicomp products from the toy world. It's called Clickables and it's a product from a Hong Kong company called TechnoSource. It's part of Disney's new Fairies initiative.

Source: Disney Clickables
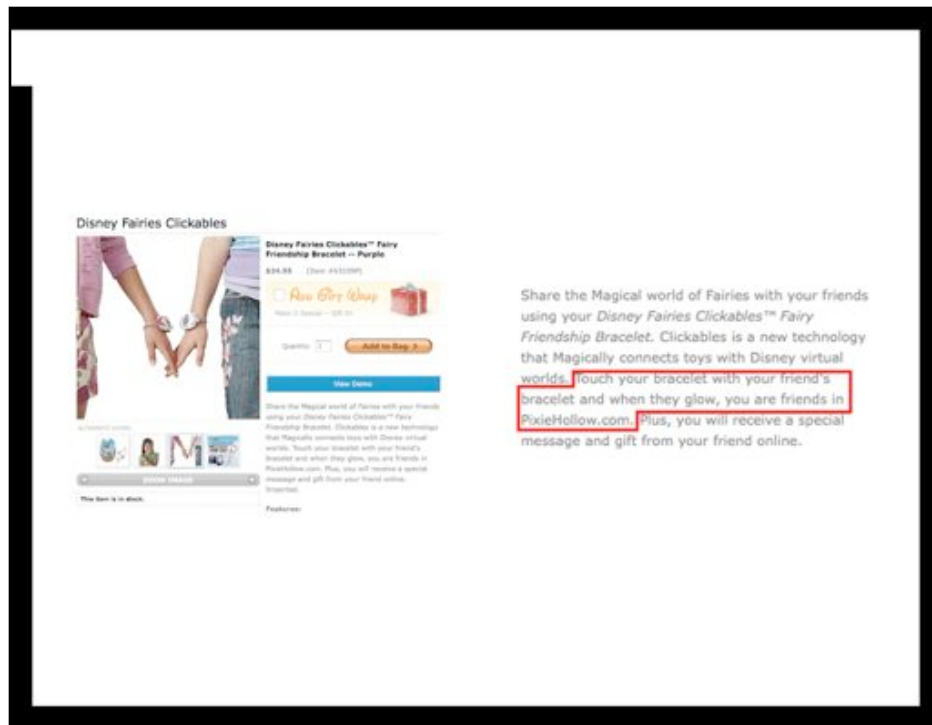
Here's one of the ways that works: when two kids put their Clickables bracelets together, their avatars link up in Pixie Hollow, the online social network associated with the Fairies brand. This bridges the physical world of kids with their social network in a transparent and familiar way. All of the products in this line have such an online-offline existence. Another example: when you get one of the charm bracelets and you touch the charms to the USB-connected jewelry box, your fairy avatar gets a version of the same charm.

This is a series of Internet connected appliances by Salton, the people who brought you the George Foreman Grill. It's been out for several years. For example, the microwave has a barcode scanner built in: when you scan some food, it goes out to their server, gets the cooking instructions and programs itself.

This is the Vizio Connected HDTV, announced at CES in January. It lets you subscribe to various kinds of content services directly from your TV.

All of these are dedicated hardware devices that use a small amount of computing and networking to create highly focused experiences.

The consumer electronics press calls them gadgets, which is probably appropriately related to widget, but discussion about them tends to be lightweight banter about inappropriate applications of computer technology and whether you could run Linux on them. That sells them short. We cannot underestimate the impact of these devices.

Which brings me to concept I call information shadows, which Tim brought up in his keynote.

Every object in our modern world has an enormous quantity of data associated with it. Specs, reviews, discussions, photos, videos, prices, carbon load analyses, etc. I call this collection of data an object's information shadow. Virtually every object has one and it exists simultaneously in two worlds: the physical world and the world of data.

Until recently, however, accessing the information shadow was difficult. The world of objects and the world of information shadows were separated by the difficulty of getting at the information.

£12.99   GRAPHIC NOVEL
ISBN 0-224-07925-5
ISBN 978-0-224-07925-9

9 780224 079259

JONATHAN CAPE

Yes, today you can photograph a book's barcode in a store and see how much you can get it for on Amazon. But books are a rare example. The world of barcodes is highly fragmented. When you're in a store, you typically don't know what the barcode means, the store does, because the store has the database that associates barcodes with the products they carry and the only thing that database has in it are the products the store carries. And then, they only know a small part of what's going on because a barcode only identifies the class of objects, not the individual object and only has the data that they put into it.

Photo CC from http://www.flickr.com/photos/dumbledad/298650884/

Technologies such 2D barcodes or RFIDs mean that every item can have a unique identifier.

When these are coupled with lightweight processing and networking we can suddenly see the world of information shadows as we're interacting with the world of objects. This is how the world of shadows and the material world get sewn together.

Image source: SmartCorq

You can, hypothetically, look at any object and know where it was made, what it is made of, what your friends think of it, how much it sells for on Ebay, how to cook it, how to fix it, how to recycle it, whatever. Any information that's available about an object can now be available immediately and associated with that object.

Image source: Yottamark

Paraphrasing Yahoo!'s Tom Coates, as soon as can digitally point at a thing's information shadow we can do mashups with it. The shadow now has handles you can grab onto. Now that we have bridged the physical world with the world of information shadows, the mashups we do in the shadow world can have direct effects in the real world, and vice versa.

Photo CC by lovestruck, found on Flickr.

Which brings me to what I believe is the next interesting implication of these technologies, the conversion of everyday objects into services.

Once we can identify unique objects in the world digitally, we can start thinking of them in profoundly different ways. Once uniquely identified, an object stops being a standalone tool and becomes a representative of a service. It becomes the service's avatar, a physical manifestation of a digital service.

Photo CC by wwarby, found on Flickr.

http://www.flickr.com/photos/wwarby/3297208230/

For example, the iTunes Music Store is a service. Here are two avatars of that service: the iPod and AirTunes. Without the service, they are much less useful as devices.

Courtesy of Apple Computer.

The Kindle is an avatar of the Amazon Kindle Store.

The Dash Connected GPS is an avatar of Dash's data aggregation service, which mashes up information about points of interest such as stores or historical markers and other services, such as traffic information, with location data.

A number of familiar appliances--cell phones, bank machines--are pure avatars of a service. They are tools that are literally worthless without the networks they're attached to. The object dematerializes into the service.

When you buy into a service you get what's a already a common mashup between the world of information and the world of physical objects, the subscription.

What's a subscription?

Well, it's an agreement between a publisher and subscriber that one will provide a service of a certain type to the other. In the case of the New England Journal of Medicine, it's medical information, with one of the avatars being a softcovered book that's delivered every week.

In actuality, the book is just an avatar. As a subscriber, what you own is the right to the information contained within that book, which can be sliced up and delivered in a number of ways. I can get it the information in paper form, on a website, or on a mobile device. The specific physical avatar is not the service, it's a representative of the service.
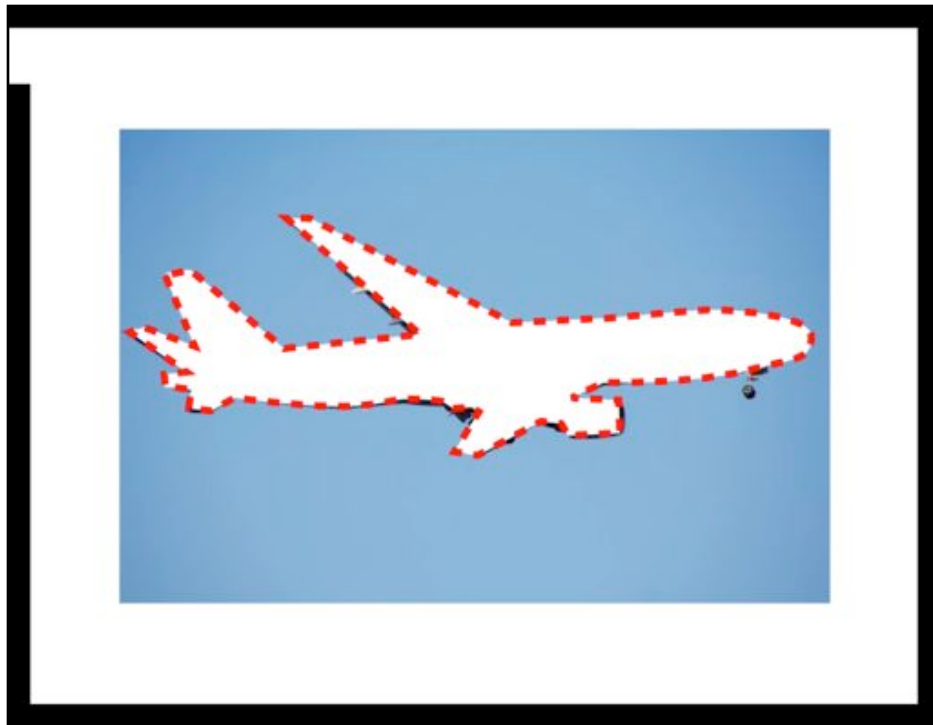
Let me give you another, less familiar example. Most airlines don't own their own planes and haven't since 1965. They lease them from General Electric, sometimes complete with flight crew and ground crew. GE actually owns them and, as I understand it, in turn leases the engines from another division of itself. When an airline needs more capacity, it leases some more. What an airline owns is a promise from GE that it will provide the service of flight to the airline for a specific period. GE's engine division, in turn provides the plane division with the service of thrust.

Let me bring this down to earth. Large-scale sharing of resources like this is not a new concept. Real estate has been leased for eons and transportation and factory equipment for centuries. But by being able to track and identify physical objects digitally, to create mashups between physical objects and their information shadows, we are making this affordable and profitable at ever smaller scales.

When you buy into a car sharing service such as City Carshare or Zip car you subscribe to a service.

For those who aren't familiar with this service. Each car is connected to a central network. You can only open the car and start the engine when your specific keyfob RFID is scheduled to open and start it. It uses a GPS to track where the car is, whether it's been dropped off at the right location, and how far it's been driven. All of that is transparent to you, the subscriber. The relationship you have with these cars is very different than rentals. Your experience of the service is much like your own car because you have access to it 24 hours a day, 7 days a week, with very little advance notice.

However, unlike an owned car, it's a car possibility space. This is an ad from Zipcar that shows the implicit power of this kind of system, from the consumer perspective. From the end user perspective you get exactly the kind of car you want when you want it and you don't have to worry about street parking. From the social perspective, it means that resources are used more efficiently: the economies of scale for buying and repairing a fleet of vehicles is significantly lower than individual ownership. From the corporate perspective, it represents an ongoing source of revenue.

It also starts to raise questions about ownership. To paraphrase Bruce Sterling, why should I own a bicycle and my neighbor own a bicycle, when we typically don't need to use one at the same time? Why does everyone on the block need to own their own wheelbarrow?

Photo CC by alykat, found on Flickr.
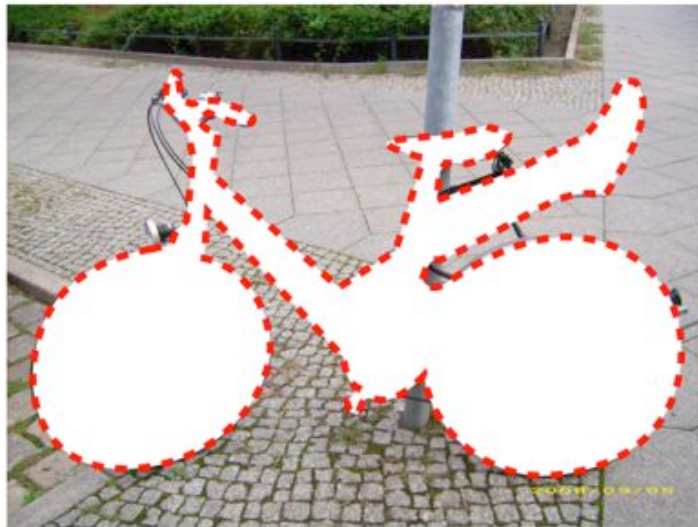
In fact, bicycles are the next step. The German Call-a-Bike program, run by the rail service is run through your phone. You need a bike, you find one of these bikes, which are usually at major street corners. You use your mobile phone to call the number on the bike. It gives you a code that you punch in to unlock the bike lock. You ride the bike around and when you've arrived, you lock it. The amount of time you rode it automatically gets billed to your phone, by the minute. The program would not be possible without item-level identification and wireless networking technology and is much more successful than all of the free bike programs because it has built in financial incentives for everyone involved, and yet provides significant social goods.

Imagine now if the service gave you the option to publish your bike riding times to an RSS feed. You could mash it up to create a personal exercise program that was monitored through your phone. All the pieces are already there.

Photo CC by probek, found on Flickr.
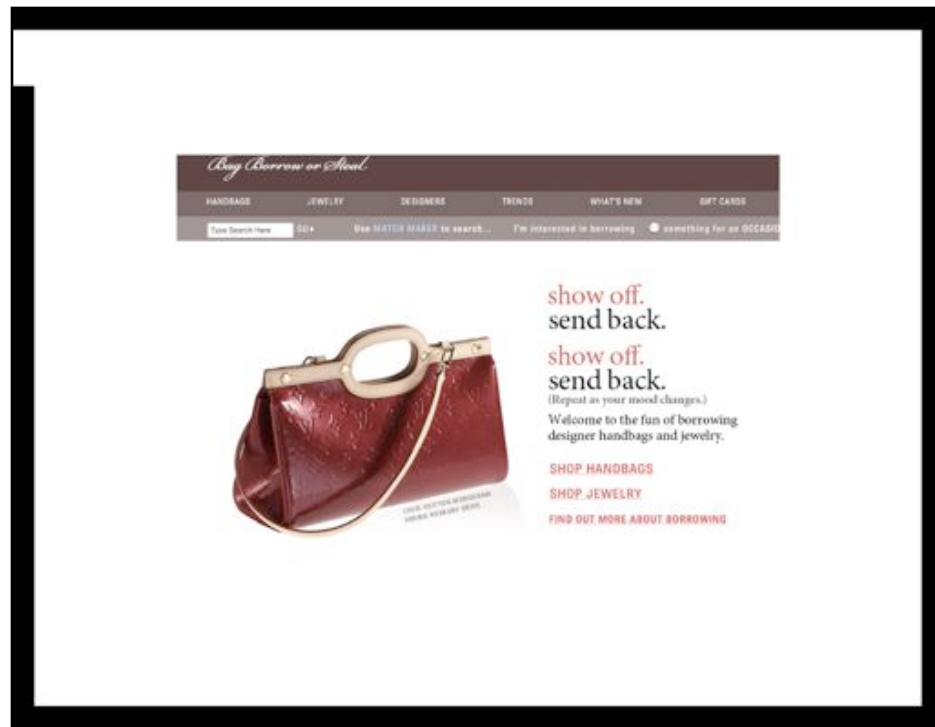
Here's another example that points to some exciting possibilities. Bag, Borrow or Steal is a designer purse subscription site. It works like Netflix, but for really expensive handbags.

It's fashion by subscription and it again points to a new way of thinking about the design of familiar objects and challenges the value and meaning of ownership.

Photo CC by bs70, Flickr
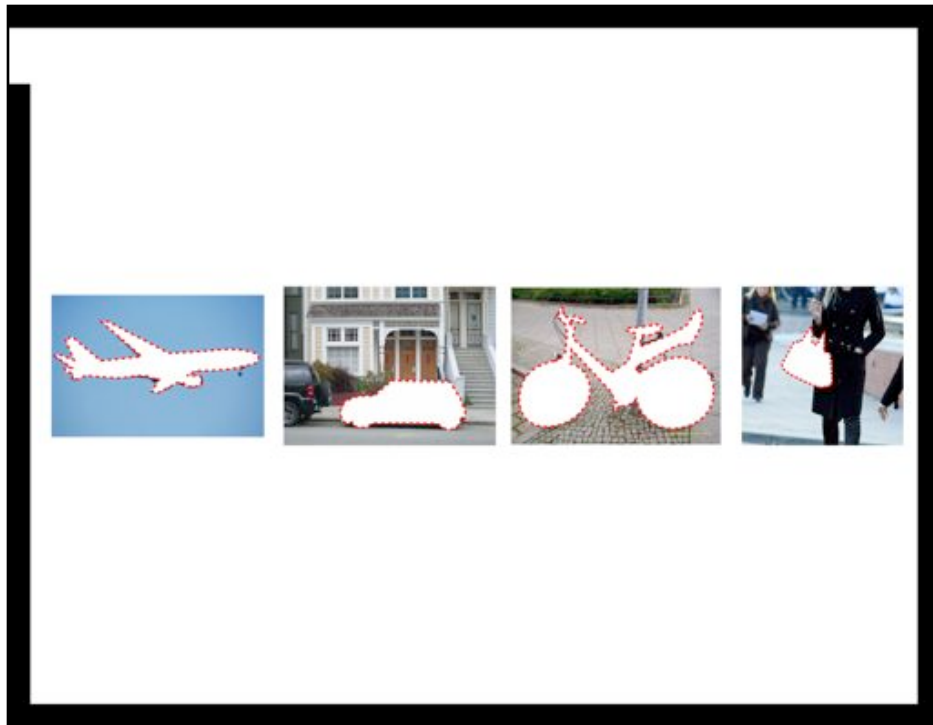
Notice a trend? It's getting cheaper all the time to create services out of objects, roughly paralleling the price drop in tracking individual objects and communicating their status.

Now what happens when such devices start feeding information back to the Net? That changes the game again. This is Botanicalls, which also Tim mentioned. It twitters when your plant is thirsty. It's a mashup between a humidity sensor and Twitter, mediated by a small amount of processing and networking.
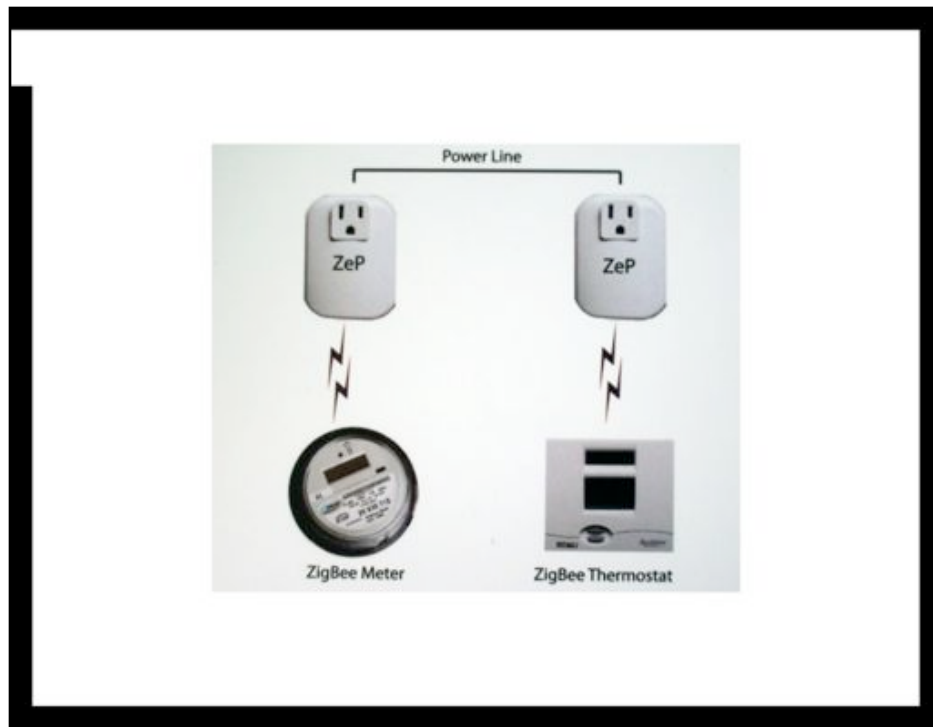
Now what happens when you do a mashup between an electric meter, real-time energy price information and the switches in your house?

This already exists, at least in reference design format. I took this from a brochure from Yitran, an Israeli company.

Imagine if lights were to dim or go off, or the temperature goes up or down based on energy prices. You could say, I like my room this bright, but not if it's going to cost me an arm and a leg. That information could then roundtrip back to the energy provider, giving them much more information about how energy is used.
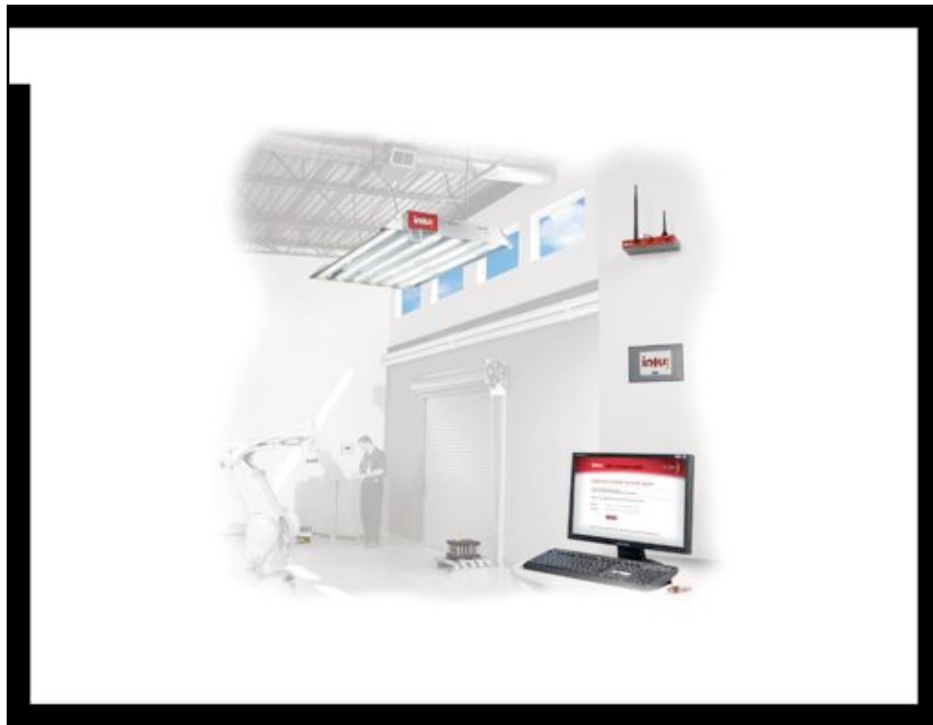
This is from a slide from Kanepi Innovations, a Michigan company that also has technology that does this.

You can already do the tracking stuff. Products like Violet's mir:ror and Tikitag let you uniquely identify anything.

While intermediary datastream brokerage and routing services like Pachube give you datastreams that you can then mashup.

By year end 2012, physical sensors will create 20 percent of non-video internet traffic. We are all familiar with CCTV systems for monitoring traffic movement, license plates and many other applications, but how about collecting data from the hard-disk shock sensors in your notebook to collect data to better understand earth tremors and earthquakes? The extent and diversity of real-time environmental sensing is growing rapidly as our ability to act on and interpret the growing volumes of data to capture valuable information increases. Gartner says organisations should consider how use of the growing volume of real-time data might create new business models and enable better informed business decision making.

Gartner expects that in 3 years 20% of Internet traffic will be created by sensors, so this movement is already well underway.
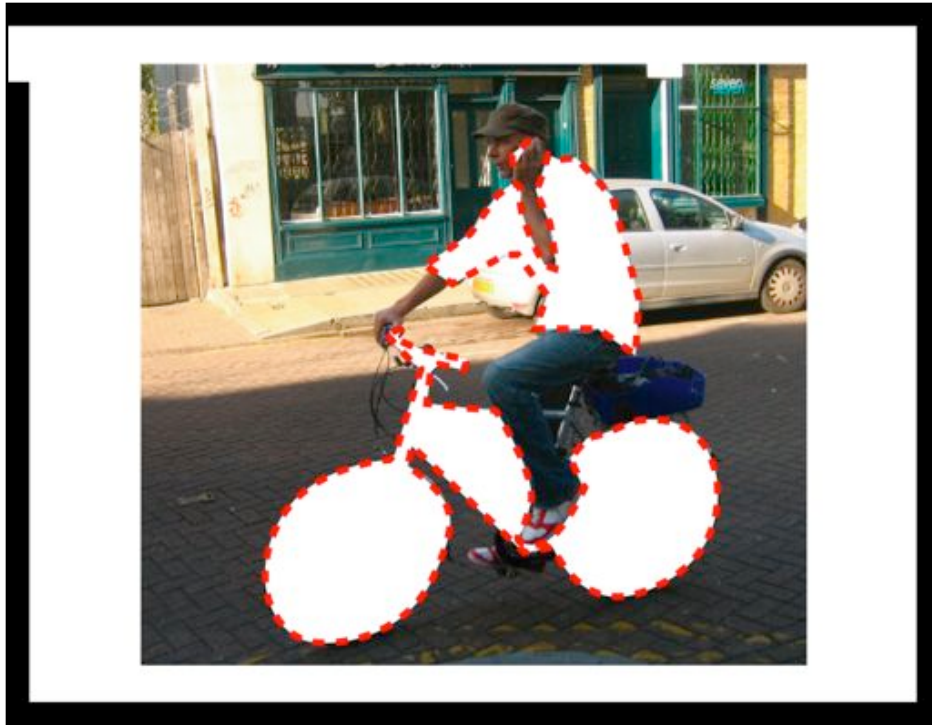
You see where I'm going with this. This idea is already out there.

The formula is pretty straightforward:

One part everyday need.

One part cheap information processing hardware.

One part lightweight networking.

Define some useful behavior (that's the hard part, of course, since the rest of this technology is basically off the shelf).

And you create a mashup.

With each mashup you define a completely new tool, an avatar of a service that has never existed in the world. I think it's an incredibly powerful approach.

This is a profound shift because it means that we no longer have to think about how to simulate the world inside a computer, whether it's literally, informationally or socially. That kind of simulation takes a lot of processing power and usually falls short of its goals. We can now get much of the benefit of being online, but engage with the world directly.

Photo CC by FluxBit, found on Flickr
http://www.flickr.com/photos/-fumtu/2560734515/

Hacking, Mashing, Gluing: Understanding Opportunistic Design
Hartmann, B.   Doorley, S.   Klemmer, S.R.
Stanford Univ., Stanford, CA;

This paper appears in: Pervasive Computing, IEEE
Publication Date: July-Sept. 2008
Volume: 7, Issue: 3
On page(s): 46-54
ISSN: 1536-1268
INSPEC Accession Number: 10090784
Digital Object Identifier: 10.1109/MPRV.2008.54
Current Version Published: 2008-07-15

Mike Kuniavsky
mikek@thingm.com

Thank you.

I also want to acknowledge this paper by Bjoern Hartmann, Scott Dooley and Scott Klemmer as being especially influential in my thinking about this topic.

Hacking, Mashing, Gluing: Understanding Opportunistic Design
Hartmann, B.   Doorley, S.   Klemmer, S.R.
Stanford Univ., Stanford, CA;