

# Promise and Peril: A librarian's perspective on the internet of things

---

Andreas K. Orphanides  
Associate Head, User Experience  
NCSU Libraries  
[akorphan@ncsu.edu](mailto:akorphan@ncsu.edu)

**NC STATE UNIVERSITY**



What we talk  
about when we  
talk about the  
Internet of Things

# An IOT device is...

# An IOT device is...

- ▶ A thing.

# An IOT device is...

- ▶ A thing. (Not a GPC.)

# An IOT device is...

- ▶ A thing. (Not a GPC.)
- ▶ With inputs and/or outputs.



# An IOT device is...

- ▶ A thing. (Not a GPC.)
- ▶ With inputs and/or outputs.
- ▶ Connected to a network.

# Useful purposes!

# Useful purposes!

- ▶ Remote sensing

# Useful purposes!

- ▶ Remote sensing
- ▶ Remote/Autonomous control

# Useful purposes!

- ▶ Remote sensing
- ▶ Remote/Autonomous control
- ▶ Machine learning

# Useful purposes!

- ▶ Remote sensing
- ▶ Remote/Autonomous control
- ▶ Machine learning
- ▶ Network interaction

# The Internet Of Things Will Be The World's Biggest Robot



**Bruce Schneier**, CONTRIBUTOR

*I am the CTO of Resilient Systems, Inc.* [FULL BIO](#) ▾

Opinions expressed by Forbes Contributors are their own.



*(Photo by Bill Pugliano/Getty Images)*

The Internet of Things is the name given to the computerization of everything in our lives. Already you can buy Internet-enabled thermostats, light bulbs, refrigerators, and cars. Soon everything will be on the Internet: the things we own, the things we interact with in

What we talk  
about when we  
talk about  
libraries



A library is...

# A library is...

- ▶ Spaces.

# A library is...

- ▶ Spaces.
- ▶ Services.

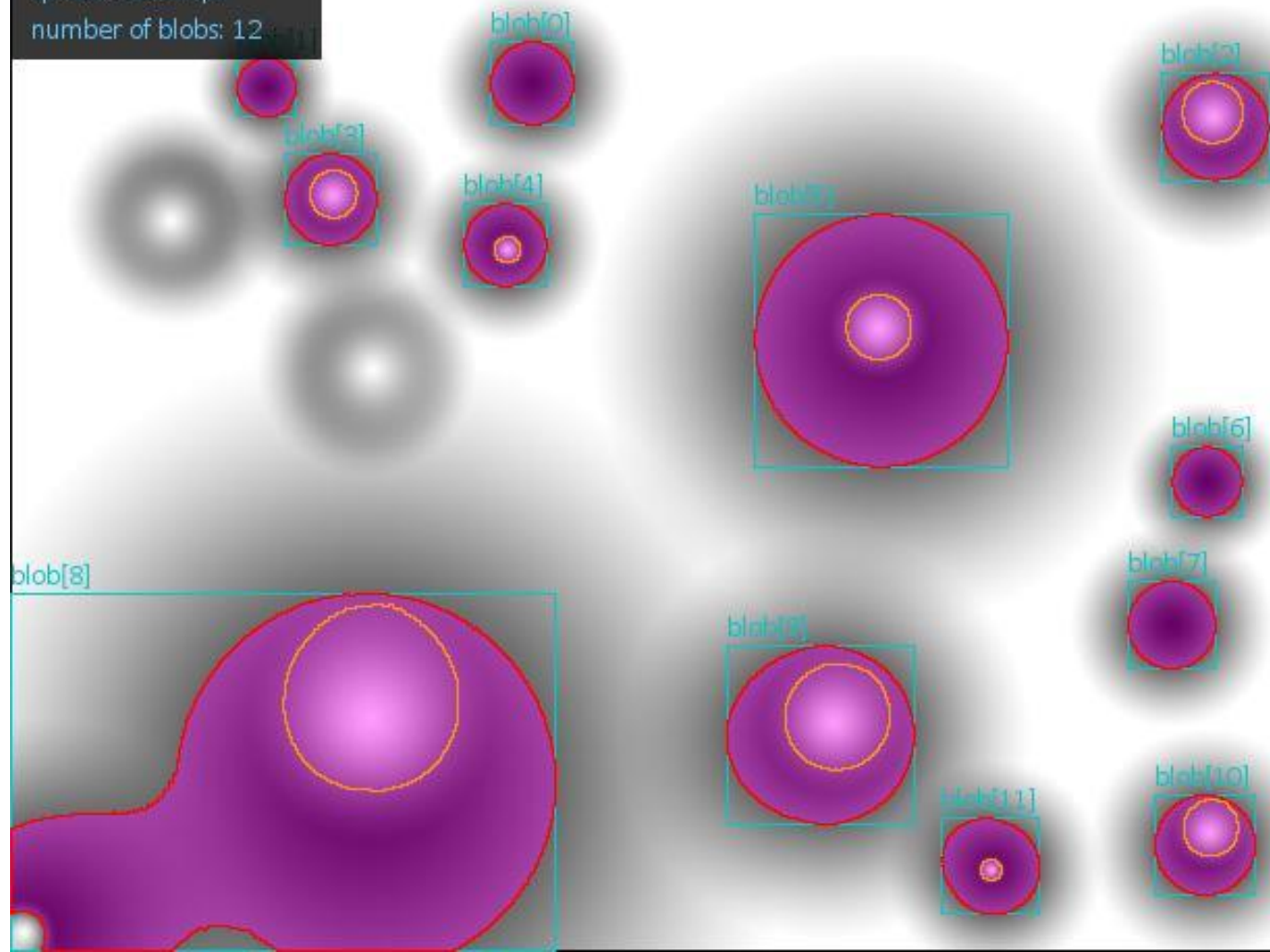
# A library is...

- ▶ Spaces.
- ▶ Services.
- ▶ Collections.

SPACES



speed: 50.59 fps  
number of blobs: 12



[HOME](#)[MAP](#)[ABOUT](#)[API](#)

Download on the  
App Store

Architectural and Fine Arts Library 1

41%

Architectural and Fine Arts Library 2

66%

Architectural and Fine Arts Library 3

99%



# Search, find and connect with iBeacon



SERVICES

[◀ Back to Makerspace](#)

### NEED HELP?

Request a technology  
consultation →

Email us →



Lauren Di  
Monte



Adam Rogers

# Internet of Things

*"The Internet of Things (IoT) is a blending of software and hardware, introducing intelligence and connectedness to objects and adding physical endpoints to software. Radical changes in the hardware development process have made the IoT—and its vast possibility—accessible to anyone."* — Jon Bruner & Mike Loukides, [O'Reilly Media](#)

You can use the tools of the IoT for all sorts of projects, such as designing products like smart watches and door locks, logging data for field research, prototyping "smart home" lighting or energy monitoring, and much, much more.

Radically affordable WiFi modules like the ESP8266 and modular, easy-to-set-up web services like IFTTT (see below) make this exciting development in technology available to all.

### IOT WI-FI ACCESS ON CAMPUS

For an on-campus solution, the Libraries has partnered with NCSU's Office of Information Technology (OIT) to create *Makerspace/OT*, a more open network for experimenting with the Internet of Things in the D.H. Hill Makerspace. Off campus, you should be able to set

[← Back to Makerspace](#)

## HOURS

Today	10am - 10pm
Nov 23	noon - 6pm
Nov 24	closed
Nov 25	closed
Nov 26	closed
Nov 27	closed

Makerspace hours: [Hill](#) | [Hunt](#)

## NEED HELP?

Request a technology consultation [→](#)

Email us [→](#)



# Makerspace at Hill



*The D. H. Hill Library Makerspace is now open!* This space gives hands-on access to the emerging technologies of making, and will enable many more students and faculty to work with 3D printing, 3D scanning, electronics prototyping, and other Maker tools.

The tools listed below as **Available to borrow** can be checked out at the D. H. Hill Ask Us desk. Those under **Use in the library** are available in the D. H. Hill Makerspace for users who have been through our [Orientation](#).

## UPCOMING WORKSHOPS

DEC

1

D.H. Hill Makerspace  
Orientation  
2:00 pm to 2:45 pm

[View all workshops →](#)

## LIBRARY STORIES



[Threading the Needle: Fostering Student Success Through Making](#)



[Remaking Teaching: Prototyping New Technologies for the Classroom](#)

[All stories →](#)

# The Internet of Things with BuzzFeed's Christine Sunu



## WHEN

September 19, 2016  
6:00pm - 9:00pm

## WHERE

- [D. H. Hill Makerspace](#) at the D. H. Hill Library

## WORKSHOP DESCRIPTION

Join Christine Sunu, BuzzFeed's GE Internet of Things Fellow at the Open Lab for Journalism, Technology, and the Arts, in this interactive workshop that explores IoT technologies with a focus on internet-connected toys and the potential available in connecting emotions and technology.

Christine Sunu is the GE Internet of Things Fellow in BuzzFeed's Open Lab for Journalism, Technology, and the Arts. Her research is focused on the links between emotion, design, media, and IoT. She writes and speaks widely about the importance of human

## INSTRUCTOR



**Lauren Di Monte**  
*NCSU Libraries Fellow,  
Cyma Rubin Fellow*



**Josephine McRobbie**  
*Assistant Director and  
Chief of Staff*

# Coding for Wearables I



## WHEN

September 23, 2016  
9:30am - 11:00am

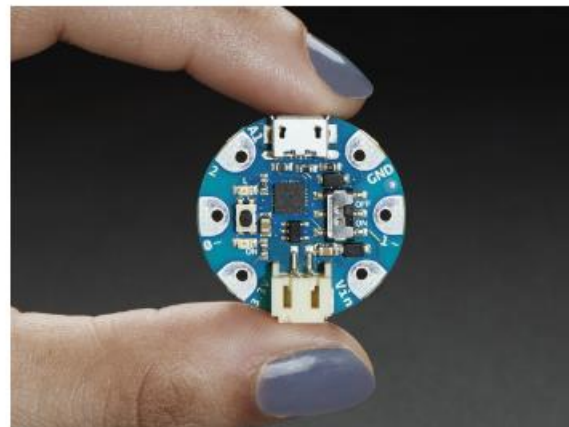
## WHERE

- [D. H. Hill Makerspace](#) at the D. H. Hill Library

## INSTRUCTOR



## WORKSHOP DESCRIPTION



In this session you'll learn how to program the [Arduino Gemma](#), a microcontroller designed for





### Occipital Structure 3D Scanner

Senses 3D data for many applications. Checks out with an iPad Air 2 for handheld 3D...

*Walk Up,*

*1 Week*



### Intel Galileo Kit

The Galileo is a single-board computer that runs a Linux-based operating system. The...

*Walk Up,*

*2 Weeks*



### Moog Werkstatt-01 Analog Synthesizer

The Moog Werkstatt-01 is a patchable, completely analog synthesizer. Excellent...

*Walk Up,*

*1 Week*



### LightBlue Bean

The LightBlue Bean is a Bluetooth Arduino microcontroller. Using Bluetooth 4.0, it is...

*Walk Up,*

*1 Week*



### NeuroSky MindWave Mobile Brainwave Starter Kit

Learn about how your brain responds to various stimulus with the MindWave Mobile...



### Muse Brain Sensing Headband

This brain sensing headband is a brain fitness tool that measures brain signals much...

*Walk Up,*



### iRobot Create 2 Programmable Robot

Create 2 has a variety of programming methods to grasp the fundamentals of robotics,...



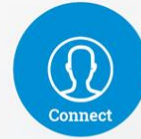
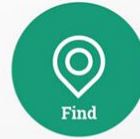
### Sphero SPRK Robotic Ball

The Sphero SPRK Edition is Sphero's robotic ball platform designed to give orders to...

*Walk Up,*

# Enhanced library services

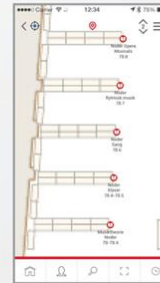
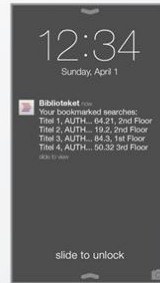
## that help users to help themselves

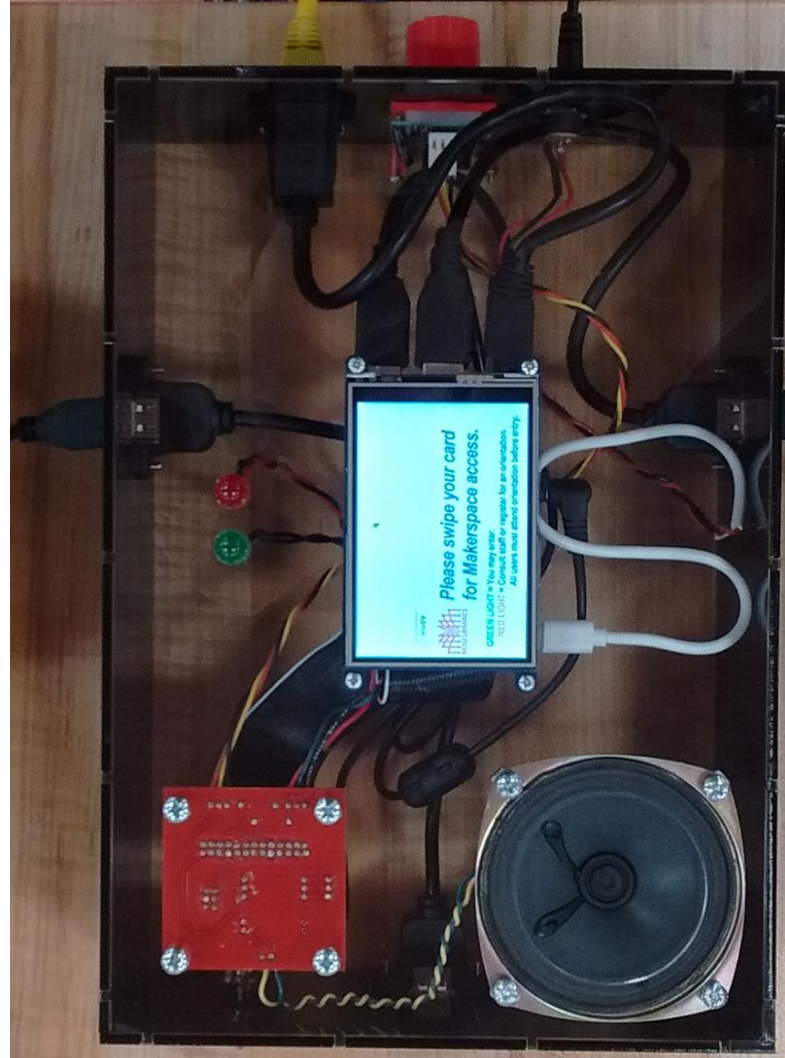


The research showed that people need help with navigating the library.

The app assist in the most complex tasks of the user journey: Searching, finding and connecting to the library's knowledge base.

By giving users a tool to help themselves in these instances, the library can use its resources for content curation and extended opening hours.







COLLECTIONS



### Occipital Structure 3D Scanner

Senses 3D data for many applications. Checks out with an iPad Air 2 for handheld 3D...

*Walk Up,*

*1 Week*



### NeuroSky MindWave Mobile Brainwave Starter Kit

Learn about how your brain responds to various stimulus with the MindWave Mobile...



### Intel Galileo Kit

The Galileo is a single-board computer that runs a Linux-based operating system. The...

*Walk Up,*

*2 Weeks*



### Muse Brain Sensing Headband

This brain sensing headband is a brain fitness tool that measures brain signals much...

*Walk Up,*



### Moog Werkstatt-01 Analog Synthesizer

The Moog Werkstatt-01 is a patchable, completely analog synthesizer. Excellent...

*Walk Up,*

*1 Week*



### iRobot Create 2 Programmable Robot

Create 2 has a variety of programming methods to grasp the fundamentals of robotics,...



### LightBlue Bean

The LightBlue Bean is a Bluetooth Arduino microcontroller. Using Bluetooth 4.0, it is...

*Walk Up,*

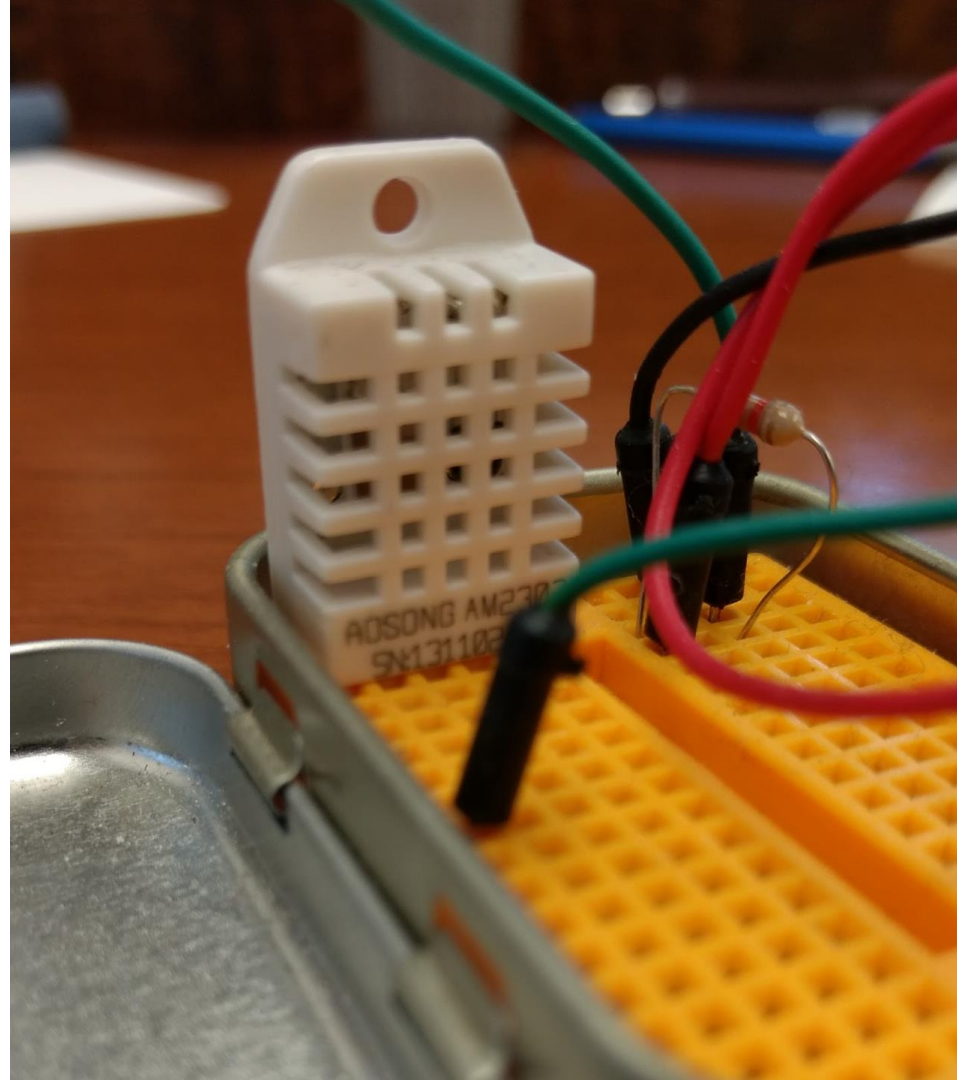
*1 Week*

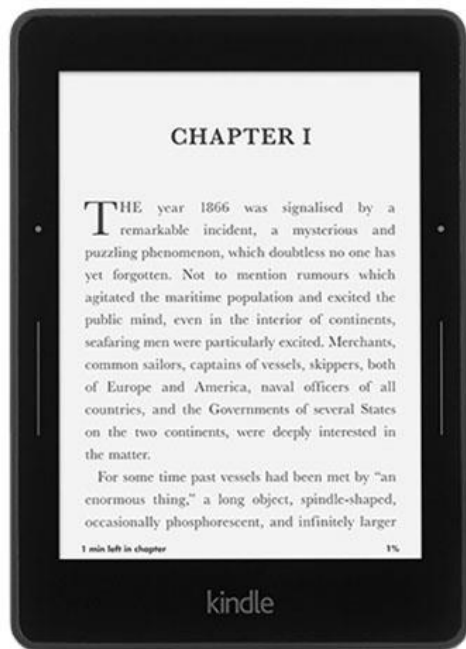


### Sphero SPRK Robotic Ball

The Sphero SPRK Edition is Sphero's robotic ball platform designed to give orders to...

*Walk Up,*





# Challenges

# Challenges

- ▶ Vendor vs. Homebrew

# Challenges

- ▶ Vendor vs. Homebrew
- ▶ Create  $\Rightarrow$  Maintain

# Challenges

- ▶ Vendor vs. Homebrew
- ▶ Create  $\Rightarrow$  Maintain
- ▶ Managed account woes



What we talk  
about when we  
talk about  
librarianship

# Librarians believe in...

# Librarians believe in...

- ▶ Knowledge discovery.

# Librarians believe in...

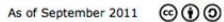
- ▶ Knowledge discovery.
- ▶ Universal access.

# Librarians believe in...

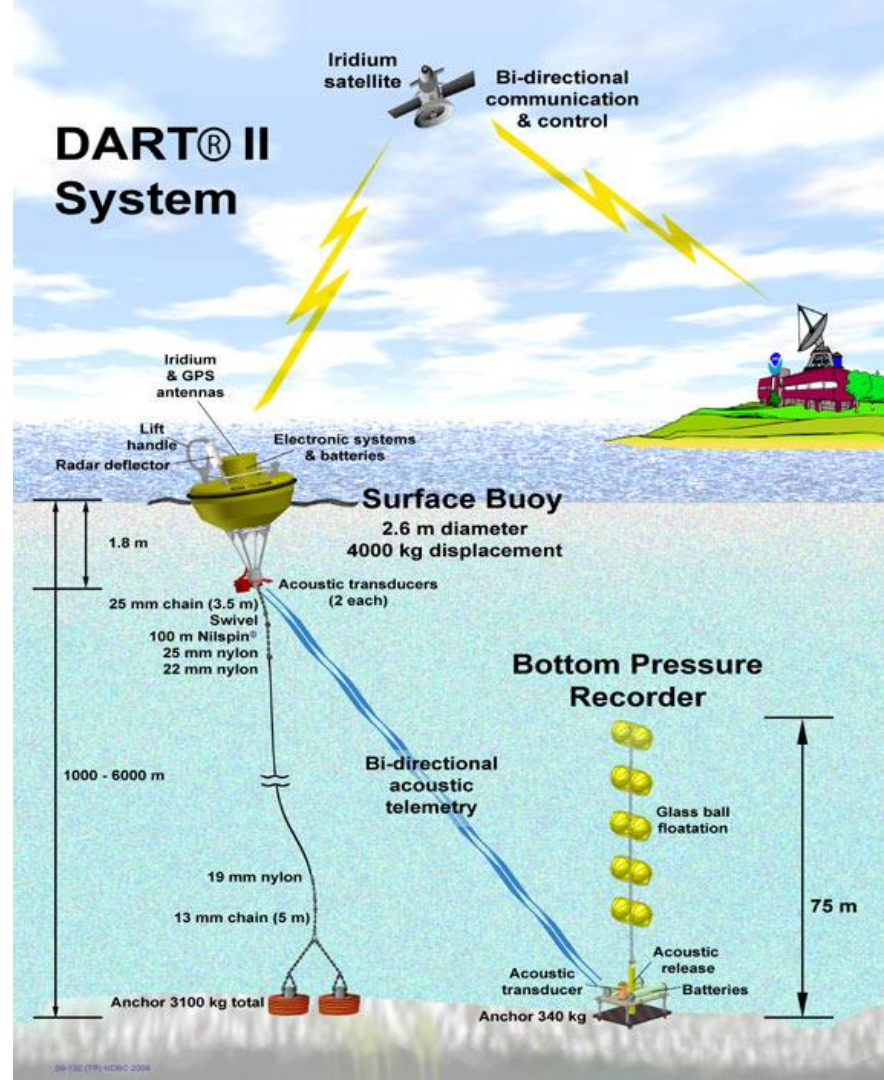
- ▶ Knowledge discovery.
- ▶ Universal access.
- ▶ Intellectual freedom.

KNOWLEDGE

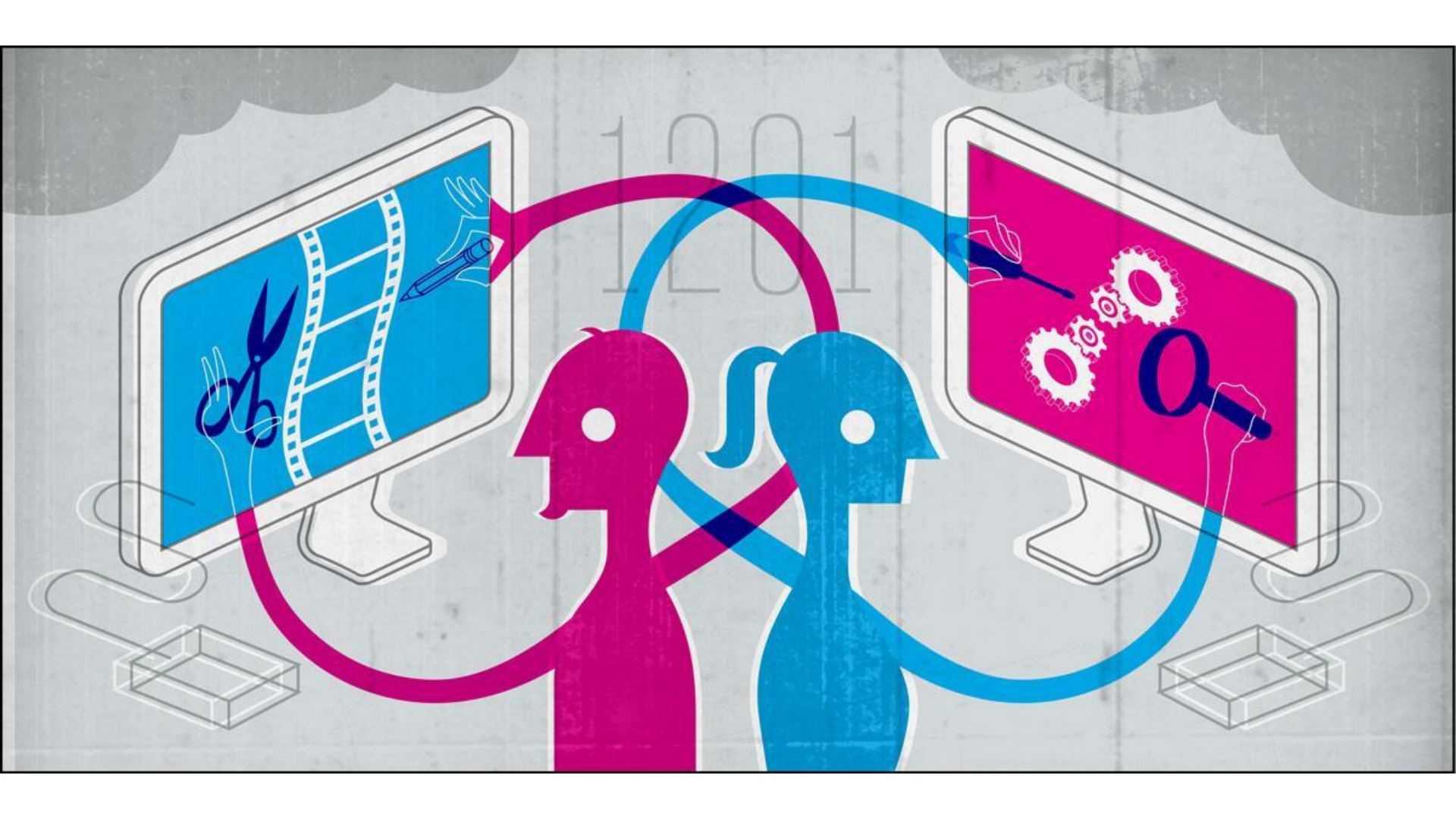
DISCOVERY











# PRINT ME IF YOU DARE

FIRMWARE UPDATE ATTACK AND THE RISE OF PRINTER MALWARE

HAVE **YOUR** EMBEDDED SYSTEMS  
B E E N   E X P L O I T E D ?

HOW DO YOU KNOW FOR **SURE**?

# US DMCA rules updated to give security experts legal backing to research

It's taken years, but finally, cybersecurity professionals have been given license to reverse engineer technology.



By Charlie Osborne for Zero Day | October 31, 2016 -- 10:56 GMT (03:56 PDT) | Topic: Security



## RELATED STORIES



Security  
**Mirai botnet attack hits thousands of home routers, throwing users offline**



Security  
**Tech support scams evolve, borrow tricks from ransomware creators**



Security  
**Singapore telcos to support GSMA authentication standard**



Security  
**Why a recount is important, and why Trump should support it**

## NEWSLETTERS

### ZDNet Security

Your weekly update on security around the globe, featuring research, threats, and more.

Your email address

SUBSCRIBE

UNIVERSAL  
ACCESS

# kindleunlimited

Freedom to explore over 1 million titles and thousands of audiobooks on any device.





A black Amazon Echo smart speaker stands on a white surface in the foreground. The background is a blurred indoor scene with a person sitting at a table and some red flowers. The text "JUST ASK" is in teal, and "amazon echo" is in white with the Amazon logo.

JUST ASK  
amazon echo









## SHARE



SHARE  
62



TWEET



PIN



COMMENT  
358



EMAIL

KYLE WIENS BUSINESS 02.05.15 7:00 AM

# NEW HIGH-TECH FARM EQUIPMENT IS A NIGHTMARE FOR FARMERS



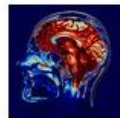
## MOST POPULAR



ENGINEERING

How a 70-Year-Old Idea  
Could Make Engines Way  
More Efficient

5 HOURS



EARLY DAYS

The Neuroscientist Who's  
Building a Better Memory  
for Humans

5 HOURS



STREAMING SERVICES

Rejoice! You Can Download  
Netflix Shows Now For an  
Offline Binge Fix

1 DAY



MORE STORIES

# Walmart to shut down DRM music servers

BY ANDY CARVELL

09.30.2008 :: 5:30AM EST



0  
SHARES

**Walmart – the second largest retailer of downloadable music in the U.S. after iTunes – are switching off their DRM servers; a move that will leave many customers unable to access their legally-purchased music.**

In an email to customers, Walmart explains:

*As the final stage of our transition to a full DRM-free MP3 download store, Walmart will be shutting down our digital rights management system that supports protected songs and albums purchased from our site ... If you have purchased protected WMA music files from our site prior to Feb 2008, we strongly recommend that you back up your songs by burning them to a recordable audio CD. By backing up your songs, you will be able to access them from any personal computer.*

# Big Brother: Amazon Remotely Deletes 1984 From Kindles



Ever bought a book from Barnes and Noble, then turned around to find it missing from your bookshelf and replaced with a voucher? Bizarre though it may seem, that's exactly what's happened to hundreds of owners of George Orwell's *1984* and *Animal Farm*





## TCP Disconnects “Smart” Lightbulb Servers, Leaves Buyers In The Dark

IMAGE COURTESY OF FRANKIELEON

August 19, 2016

9:54 am EST

By Kate Cox [@kcoxdc](#)

THE INTERNET OF  
DISCONNECTED  
THINGS

SMARTBULB

This is, unfortunately, becoming one of the most predictable stories of the early 21st century. It goes something like this: new tech product comes on the market. Consumers, finding product solves their problem, eagerly buy. Then the company that made the product turns off the server that made the thing “smart,” and suddenly early adopters are up a creek with no recourse.

This time around, the story is about lightbulbs.

# The End of Ownership

PERSONAL PROPERTY IN THE DIGITAL ECONOMY



Aaron Perzanowski and Jason Schultz

INTELLECTUAL  
FREEDOM



## Advocacy Events

## Advocacy University

## Federal Legislation & Regulation

## Issues

### Access

### Broadband & E-Rate

### Copyright

### Diversity, Equity, and Inclusion

### Ebooks

### Filters & Filtering

### Intellectual Freedom

#### Intellectual Freedom eLearning

#### Censorship & First Amendment Issues

### Library Bill of Rights

#### Access for Children and Young Adults to Nonprint Materials

# Library Bill of Rights

The American Library Association affirms that all libraries are forums for information and ideas, and that the following basic policies should guide their services.

I. Books and other library resources should be provided for the interest, information, and enlightenment of all people of the community the library serves. Materials should not be excluded because of the origin, background, or views of those contributing to their creation.

II. Libraries should provide materials and information presenting all points of view on current and historical issues. Materials should not be proscribed or removed because of partisan or doctrinal disapproval.

III. Libraries should challenge censorship in the fulfillment of their responsibility to provide information and enlightenment.

IV. Libraries should cooperate with all persons and groups concerned with resisting abridgment of free expression and free access to ideas.

V. A person's right to use a library should not be denied or abridged because of origin, age, background, or views.

VI. Libraries which make exhibit spaces and meeting rooms available to the public they serve should make such facilities available on an equitable basis, regardless of the beliefs or affiliations of individuals or groups requesting their use.

Adopted June 19, 1939, by the ALA Council; amended October 14, 1944; June 18, 1948; February 2, 1961; June 27, 1967; January 23, 1980; inclusion of "age" reaffirmed January 23, 1996.

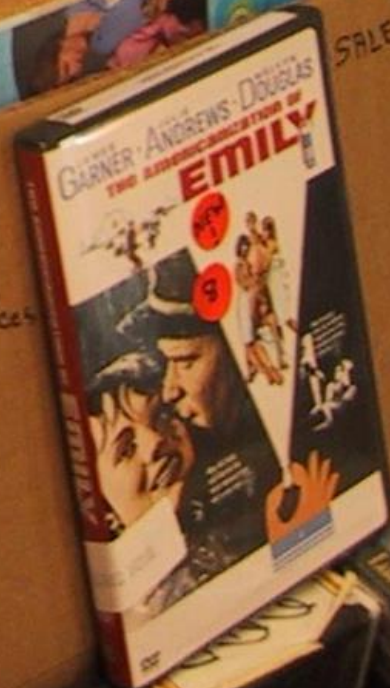
A history of the Library Bill of Rights is found in the latest edition of the [Intellectual Freedom Manual](#).

Although the Articles of the Library Bill of Rights are unambiguous statements of basic principles that should govern the service of all libraries, questions do arise concerning application of these principles to specific library practices. See the



The FBI  
has not  
been here  
(watch very closely for removal of this sign)

© 1999 Paramount Pictures. All Rights Reserved.



SALE!

GENE





## Sockets Are Mucous Membranes



Your house



YOUR HOUSE ON THE  
INTERNET OF THINGS



GEAR &amp; GADGETS —

# Peep show: inside the world of unsecured IP security cameras

Want to peer into businesses around the world, look through red light cameras ...

TOM CONNOR - 1/12/2011, 12:10 AM

77

f



If you're in public, you're on camera. If you walk into a coffee shop, the owner gets you at the register. Visit a larger store, and chances are they have your face as soon as you cross the threshold. At least one or two of your neighbors catch you on camera when you walk around your neighborhood, and many cities monitor traffic using red light cameras at major intersections. The question is no longer if you're on camera, but rather how many different angles you were caught on while going about your day.

With so much monitoring taking place, and with surveillance systems gaining more online functionality every year, it's natural that securing these systems would become... complicated. And that many many are secured incorrectly or not at all. Because so many cameras and surveillance systems are completely open, it's possible for anyone with Internet access to watch literally thousands of cameras online using only Google and a kindergartener's understanding of the 'Net. With a little time and patience, almost any given system, from a set of residential cameras to those used by your local police, can be accessed, viewed, and even reset if not properly secured. Of course, if you can do this, it means that *anyone* can do it.



# Using a Samsung smart fridge could leave your Gmail account vulnerable to hackers

Max Slater-Robins



Aug. 24, 2015, 7:54 AM

1,844



FACEBOOK



LINKEDIN



TWITTER



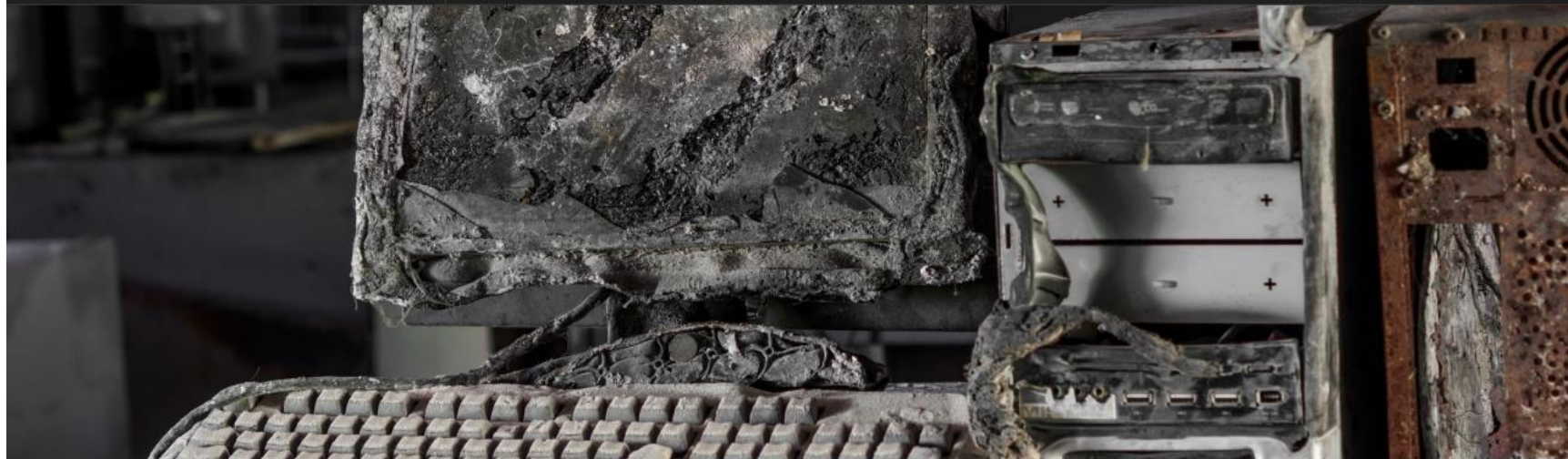
Hackers have found a way to exploit a Samsung smart fridge in order to access the owner's Gmail credentials, according to [The Register](#).

Pen Test Partners, a firm that specialises in finding exploits, discovered a man-in-the-middle vulnerability in Samsung smart fridges. A man in the middle attack is where a hacker intercepts a piece of data as it passes between a server and the device, in this instance a fridge.

The hack was discovered in Samsung's [RF28HMEBBSR](#) fridge which has a Wi-Fi capability that allows a user to show their Gmail calendar on the display. While Samsung has implemented a [Secure Sockets Layer](#) (SSL), the fridge fails to validate the certificates that come as part of the SSL protocol, leaving the device vulnerable to attack. For an SSL certificate to be valid, the browser must receive a valid code back from the website host, something Samsung failed to do.



A Samsung smart fridge. David Becker/Getty Images



# The Internet of Things Will Turn Large-Scale Hacks into Real World Disasters

July 25, 2016 // 09:30 AM EST



Written by  
**BRUCE SCHNEIER**



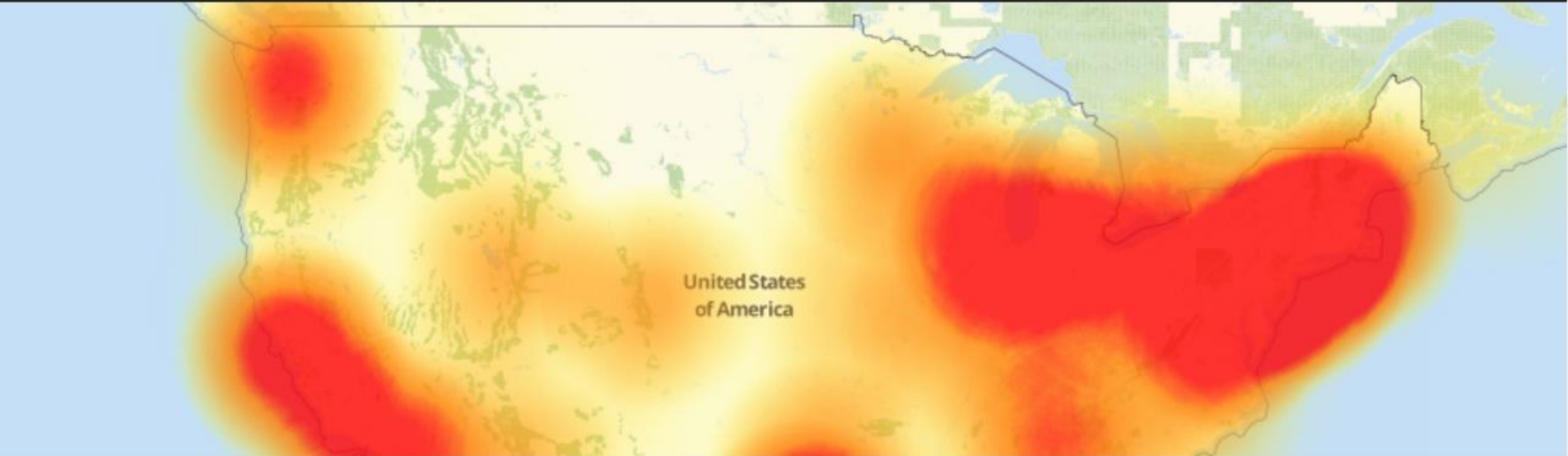
Disaster stories involving the [Internet of Things](#) are all the rage. They feature cars (both driven and driverless), the power grid, dams, and tunnel ventilation systems. A particularly vivid and realistic one, near-future fiction published last month in *New*



FOLLOW US EVERYWHERE







# Blame the Internet of Things for Destroying the Internet Today

October 21, 2016 // 04:35 PM EST



Written by  
**LORENZO FRANCESCHI-BICCHIERI**  
STAFF WRITER



A massive botnet of hacked Internet of Things devices has been implicated in the cyberattack that caused a significant internet outage on Friday.



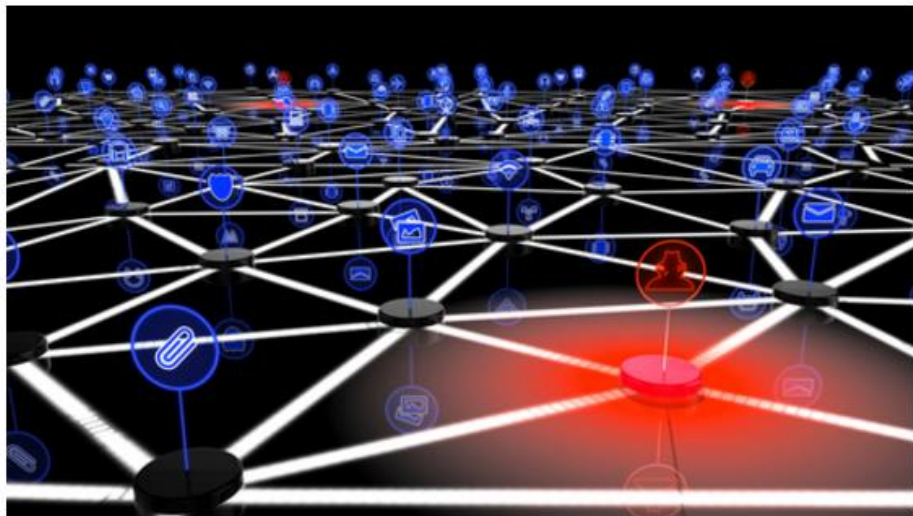
FOLLOW US EVERYWHERE



## 21 KrebsOnSecurity Hit With Record DDoS

SEP 16

On Tuesday evening, KrebsOnSecurity.com was the target of an extremely large and unusual distributed denial-of-service (DDoS) attack designed to knock the site offline. The attack did not succeed thanks to the hard work of the engineers at **Akamai**, the company that protects my site from such digital sieges. But according to Akamai, it was nearly double the size of the largest attack they'd seen previously, and was among the biggest assaults the Internet has ever witnessed.







## Johnson & Johnson Warns Patients Insulin Pump Is Hackable But “Low Risk” Of Attack

October 4, 2016

9:21 am EST

By Kate Cox [@kcoxdc](#)

STRAIGHT OUT OF  
SCI-FI

PRIVACY HACKS

JOHNSON & JOHNSON

Tech can be pretty great, and smart, connected tech can be really great. Miniaturization and the ability to control devices remotely has led to some fantastic advances in, for example, health care. But today in “wow, our glorious tech-driven future is so strange and dystopic some days,” we are reminded that anything that can be networked is vulnerable, and can be hacked.

Reuters [reports this morning](#) that Johnson & Johnson has found that one of its medical devices has a bug in it that can leave it vulnerable to remote intrusion — i.e., hacking.



CATS : ALL YOUR BASE ARE BELONG  
TO US.

What's a  
librarian to do?

What **you** can do

# What **you** can do

- ▶ Promote research

# What **you** can do

- ▶ Promote research
- ▶ Increase awareness

# What **you** can do

- ▶ Promote research
- ▶ Increase awareness
- ▶ Establish standards

**I FIGHT**

**FOR THE USERS**





# Thanks!

Andreas K. Orphanides  
akorphan@ncsu.edu



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).



# Image credits

Hunt Library: ©Jeff Goldberg/Esto. All Rights Reserved

[Hunt gates](#): Seannator (Wikipedia user). CC-BY-SA 3.0

[Heatmap](#): Measure the Future Project

[Density](#): ADI

[Copenhagen Library app](#): Andreas Schuster

[Linked data](#): Max Schmachtenberg, Christian Bizer, Anja Jentzsch and Richard Cyganiak. CC-BY-SA 3.0

Smart buoys: NOAA [\(1\)](#) [\(2\)](#)

[Pink and blue hacking](#): Electronic Frontier Foundation

[Kindle Unlimited](#): Amazon

[Nest app](#): AVLogix

[Warrant canary](#): Jessamyn West. CC-BY 2.0

[Compubody Sock](#): Becky Stern. CC-BY-SA 2.0

[All your base](#): *Zero Wing* (Mega Drive), Sega (via Albino Black Sheep)

[Fight for the users](#): *Tron*, Walt Disney Productions (via Pinterest)

Device images belong to their respective manufacturers

Article screencaps from articles listed in sources

All other images NCSU Libraries and North Carolina State University

# Articles referenced and further reading

Bruce Schneier, [The Internet of Things will be the World's Biggest Robot](#). Forbes, Feb 2, 2016.

Ang Cui and Sal Stolfo, [Print Me if you Dare: Firmware Update Attack and the Rise of Printer Malware](#). Columbia University Intrusion Detection Systems Lab, Dec 29, 2011

Kit Walsh, [Section 1201 of the DMCA Cannot Pass Constitutional Scrutiny](#). Electronic Frontier Foundation, Jul 21, 2016

Cory Doctorow, [GM Says you Don't Own your Car, You Just License It](#). BoingBoing, May 21, 2015

Kyle Wiens, [New High-Tech Farm Equipment is a Nightmare for Farmers](#). Wired, Feb 5, 2015

Andy Carvell, [Walmart to Shut Down DRM Music Servers](#). Geek.com, Sept 30, 2008

Pete Cashmore, [Big Brother: Amazon Remotely Deletes 1984 from Kindles](#). Mashable, Jul 17, 2009

Arlo Gilbert, [The Time Tony Fadell Sold me a Container of Hummus](#), Apr 3, 2016

Kate Cox, [TCP Disconnects “Smart” Lightbulb Servers, Leaves Buyers in the Dark](#), The Consumerist, Aug 19, 2016

Aaron Perzanowski and Jason Schultz, [The End of Ownership](#). MIT Press, 2016

American Library Association, [Library Bill of Rights](#). Jan 23, 1996

James Mickens, [Not Even Close: The State of Computer Security](#). Presentation at NDC Oslo 2015

Matt Peckham, [Play Doom on a Printer—Thanks to a Serious Security Flaw](#). Wired, Sept 23, 2014

Tom Connor, [Peep show: inside the world of unsecured IP security cameras](#). Ars Technica, Jan 12, 2011

Max Slater-Robins, [Using a Samsung smart fridge could leave your Gmail account vulnerable to hackers](#). Business Insider, Aug 24, 2015

Bruce Schneier, [The Internet of Things Will Turn Large-Scale Hacks into Real World Disasters](#). Motherboard, Jul 25, 2016

Lorenzo Franceschi-Bicchierai, [Blame the Internet of Things for Destroying the Internet Today](#). Motherboard, Oct 21, 2016

Brian Krebs, [KrebsOnSecurity Hit with Record DDoS](#). KrebsOnSecurity, Sept 21, 2016

Kate Cox, [Johnson & Johnson Warns Patients Insulin Pump Is Hackable But “Low Risk” Of Attack](#). The Consumerist, Oct 4, 2016