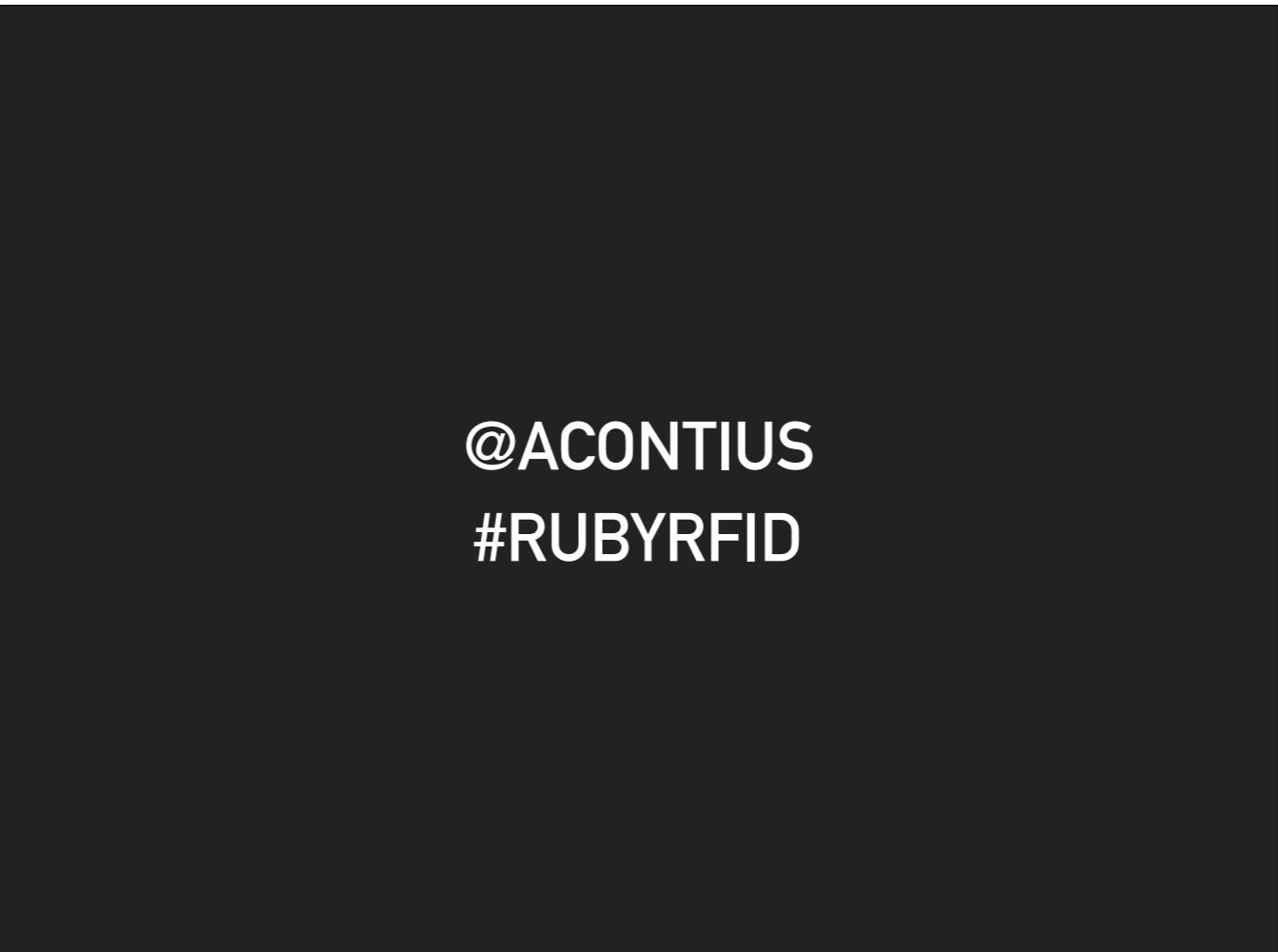


TAGGING YOUR WORLD WITH RFID

(HOW TO ANNOY YOUR FRIENDS, FAMILY AND PETS)

Tagging your world with RFID or How to annoy your friends, family and pets



**@ACONTIUS
#RUBYRFID**

You can follow the live tweet Stream on twitter at #rubyrfid

- ▶ RFID
- ▶ LIMS
- ▶ 21 CFR 11, GLP,
GMP, HIPAA,
FISMA

@ACONTIUS

ADAM WALKER

Most of my work is centered around Laboratories. I write Laboratory information management systems (LIMS) i.e. for Biobanks, Food, drug and environmental testing labs, Clinical trial support. I specialize in integrating RFID / Barcode asset tracking into these LIMS / LIS systems. Especially in the case of Manual and Robotic -80 freezers.

[twitter] https://en.wikipedia.org/wiki/Laboratory_information_management_system [/twitter]



BUGS & DRUGS



JMI Laboratories has been performing custom Microbiology testing for Antibiotic drug companies since 2000 to aid in the development of new antibiotics in the constant fight against infection diseases. We also test 60,000 samples per year gathered from around the world as part of our proprietary SENTRY surveillance program to detect the emergence of resistance to existing antibiotics throughout the world. The software team is responsible for constantly improving the custom web tools our scientists use to manage experiments and produce data analysis for our clients to use in their ongoing communication with the Food and Drug Administration and the European Medicines Agency.

[twitter]Bugs and Drugs <http://jmilabs.com/>[/twitter]



June 16th - June 19th, 2016

RUBYFORGOOD

Dedicated to making the world gooder



We'll post registration and more details here as they become available.

I encourage everyone to visit rubyforgood.org



@ACONTIUS

ADAM WALKER

My name is Adam Walker and here is a fast intro to me



@ACONTIUS

ADAM WALKER

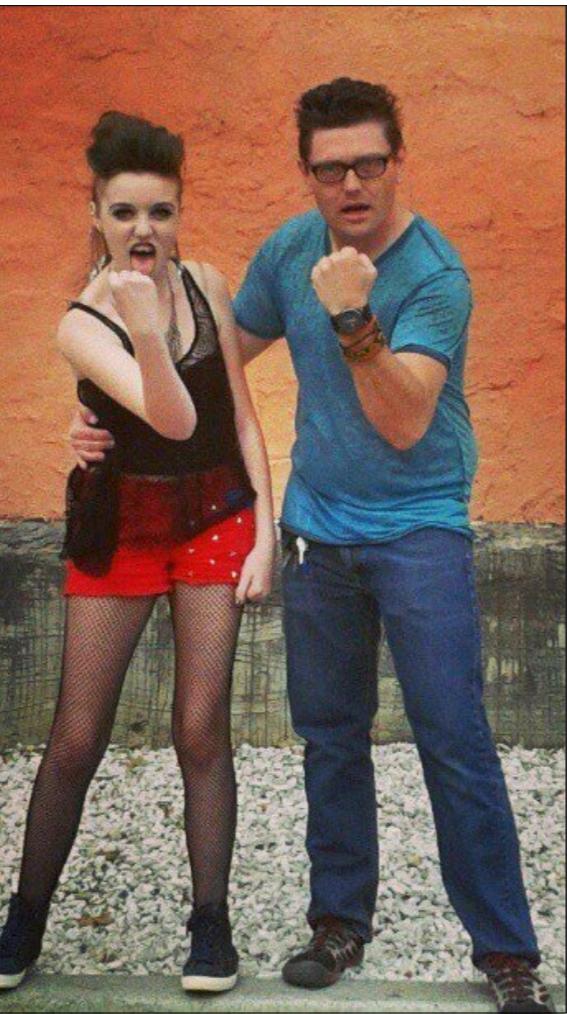
I Do a lot of hiking and prefer to do it in a kilt and crocs



@ACONTIUS

ADAM WALKER

I was a profesional Chef



@ACONTIUS

ADAM WALKER

I go to punk rock shows and ham it up with my teenage daughter



@ACONTIUS

ADAM WALKER

I'm batman



@ACONTIUS

ADAM WALKER

This is my friend Nathan

I got a mostly positive reputation at my old job for office pranks



@ACONTIUS

ADAM WALKER

The problem with my last job is I didn't have a lot of coworkers



@ACONTIUS

ADAM WALKER



@ACONTIUS

ADAM WALKER



@ACONTIUS

ADAM WALKER

Poor Nathan



The view from my airplane on the way to Rubyconf. This was special because not only was Rubyconf my first time talking to a group this size but this was my first time in an airplane.

SO WHAT IS RFID?

On to the actual presentation. What is RFID?

RFID?

Radio-frequency
identification is the wireless
use of electromagnetic
fields to transfer data

According to Wikipedia:

Radio-frequency identification is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects

[twitter] https://en.wikipedia.org/wiki/Radio-frequency_identification [/twitter]

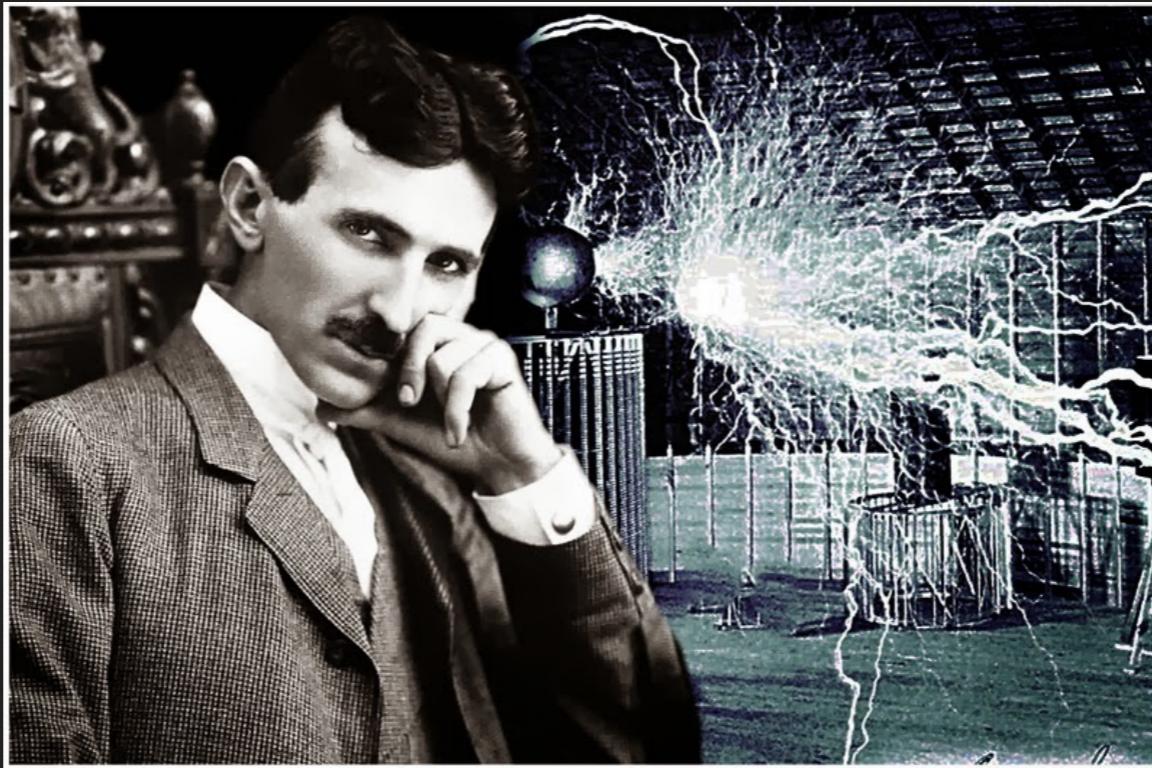
No explanation of RFID would be complete without mentioning Tesla.



No, not that Tesla.

[twitter] Tesla https://www.youtube.com/watch?v=l2q_xN2N54 [/twitter]

NIKOLA TESLA



There we go. Nikola Tesla

[twitter] Greatest Geek who ever lived <http://theoatmeal.com/comics/tesla> [/twitter]

NIKOLA TESLA

In 1894 Nikola Tesla used resonant inductive coupling to wirelessly light up phosphorescent and incandescent lamps.

In 1894 Nikola Tesla used resonant inductive coupling to wirelessly light up phosphorescent and incandescent lamps.

[twitter] resonant inductive coupling https://en.wikipedia.org/wiki/Resonant_inductive_coupling [/twitter]

NIKOLA TESLA

In 1894 Nikola Tesla used resonant inductive coupling to wirelessly light up phosphorescent and incandescent lamps.

Resonant inductive coupling is the near field wireless transmission of electrical energy between two magnetically coupled coils

Resonant inductive coupling is the near field wireless transmission of electrical energy between two magnetically coupled coils

NIKOLA TESLA

In 1894 Nikola Tesla used resonant inductive coupling to wirelessly light up phosphorescent and incandescent lamps.

Resonant inductive coupling is the near field wireless transmission of electrical energy between two magnetically coupled coils that are part of resonant circuits tuned to resonate at the same frequency.

Resonant energy transfer is the operating principle behind passive RFID tags, wireless charging and contactless smart cards.

Resonant energy transfer is the operating principle behind passive RFID tags, wireless charging and contactless smart cards.



Thank you Tesla

RESONANT ENERGY TRANSFER



(This was skipped during Rubyconf as I didn't think it was as funny as when I wrote it at 2 AM)

Not being an electrical engineer I equate it to the Truffle Shuffle energy transfer theory which is that one Chunk can cause another chunk to truffle shuffle because they are tuned to the same resonance frequency.

You cannot however make an adult Chunk truffle shuffle because they are not tuned to the same resonance frequency

PRACTICAL USES

Practical Uses

RFID USES?



So what can we use RFID for?

RFID USES?

- ▶ Race Timing



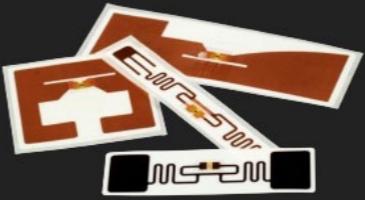
race-timing aka Timing sporting events

Tags in bibs, bracelets or shoe tags

[twitter]UHF Tracks 42,000 Runners at the New York City Marathon <http://www.rfidjournal.com/blogs/rfid-journal/entry?5368> [/twitter]

RFID USES?

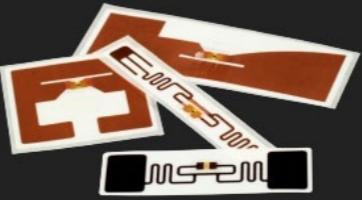
- ▶ Race Timing
- ▶ DVD Kiosks



DVD kiosks. Which is probably a terrible example. This slide should be irrelevant in a year

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication



Authentication

Doors

Computer systems

Medical Carts

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments



Toll collection and contactless payment

A number of ACTIVE RFID systems are in place for toll roads. EZ-Pass, I-Pass and FasTrack.

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments
- ▶ Asset tracking & logistics



Asset Tracking

From manufacturing to shipping Asset Tracking is the bread and butter of the RFID industry and is the market with the quickest adoption. Auto parts, pharmaceutical , construction.. all these industries use RFID to some degree.

Tracking RFID tagged cryogenic vials in Biobanks and Laboratories is my bread and butter. Nothing cooler than saving a lab tech hours searching and logging isolates. Not to mention robotic freezers are just cool. excuse the pun

[twitter]FreezerPro <http://ruro.com/software/freezerpro/overview> [/twitter]

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments
- ▶ Asset tracking & logistics
- ▶ Wireless access point



wireless access points and smartdust

Monza X-2K is a UHF RFID chip that enables users to communicate wirelessly with the processor inside electronic devices using standard UHF Gen 2 RFID readers. The chips can be programmed even when the electronic device is powered off which is a great solution for access control and security.

Smart dust which is tiny RFID chips can be used to create wireless sensor networks which are opening up new possibilities in medicine including the possibility of neural sensors for artificial limbs.

[twitter] Monza X-2K <http://www.impinj.com/products/tag-chips/monza-x-2k/> [/twitter]

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments
- ▶ Asset tracking & logistics
- ▶ Wireless access point
- ▶ Tracking of persons and animals



Tracking of Persons and animals

Use of rfid ear tags is common in industrial farming

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments
- ▶ Asset tracking & logistics
- ▶ Wireless access point
- ▶ Tracking of persons and animals



Tracking of Persons and animals

RFID tagging pets with collar tags or injectables

RFID USES?

- ▶ Race Timing
- ▶ DVD Kiosks
- ▶ Authentication
- ▶ Toll collection & wireless payments
- ▶ Asset tracking & logistics
- ▶ Wireless access point
- ▶ Tracking of persons and animals



Tracking of Persons and animals

Tracking movements of personnel within a building which is useful for high clearance environments, hospitals and laboratories.

RFID USES?

HOLD UP!!!!

TRACKING PEOPLE?

Let me take a minor little side trip because I've heard it a thousand times and I like to head this stuff off early.



RFID is cheap enough that experimenter kits are available from most of the big hobby electronics sellers for about US\$50 And it scares the living crap out of the tinfoil hat crowd. The Illuminati, Mark of the beast, New world order.. I have heard it all.

[twitter] RFID conspiracy images <https://goo.gl/wcrQTi> [/twitter]

TRACKING PEOPLE?



If you are still concerned about the government, illuminati or “the dark ones” tracking you here’s a trick.

During presentation:

stick rfid sticker on forehead

scan sticker

place tinfoil on head and rescan

The tag won’t read the 2nd time

Besides if someone wanted to track you wouldn’t the little networked computers in your pocket reading your location from satellites in space be far more efficient?

Certainly easier than reading an implantable with a range of only a few centimeters.

LIMITATIONS

Limitations or disadvantages of RFID.

LIMITATIONS OF RFID

- ▶ Physical limitations

Limitations or disadvantages of RFID.

Physical limitations like reading through liquid or metals still exist

LIMITATIONS OF RFID

- ▶ Physical limitations
- ▶ Signal Collision

Limitations or disadvantages of RFID.

It isn't always easy to read multiple RFID tags simultaneously.

Tag collision occurs when many tags are present in a small area.

Reader collision occurs when the signals from two or more readers overlap. The tag is unable to respond to simultaneous queries. Systems must be carefully set up to avoid this problem; many systems use an anti-collision protocol.

LIMITATIONS OF RFID

- ▶ Physical limitations
- ▶ Signal Collision
- ▶ Standards

Limitations or disadvantages of RFID.

Lack of standards is an issue when companies attempt to share RFID information and tracking with other organizations. Sources of potential differences include the speed at which data transmits and the techniques that manage with signal collision.

LIMITATIONS OF RFID

- ▶ Physical limitations
- ▶ Signal Collision
- ▶ Standards
- ▶ Privacy

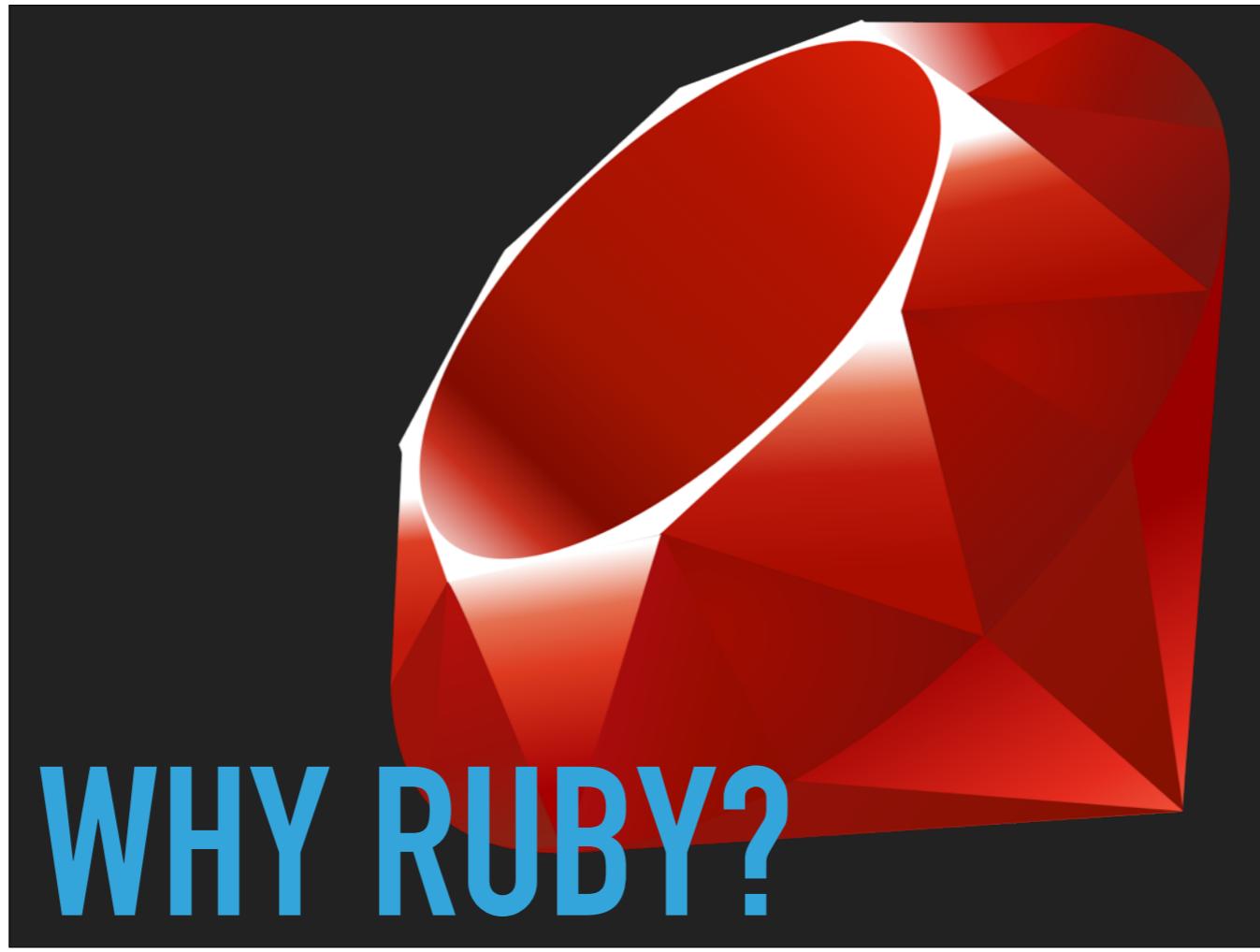


Limitations or disadvantages of RFID.

Privacy concerns. Using the right equipment it is possible to read some tags from further away than was intended which can lead to privacy issues. There are, however, some really advances in this area such as Zombie tags.

Zombie tags are a tag that can be temporarily deactivated when it leaves the store. you bring your purchase up to the register, the RFID scanner reads the item, you pay for it and as you leave the store, you pass a special device that sends a signal to the RFID tag to "die." That is, it is no longer readable.

If you bring the item back into the store (let's say to return it) it passes the special device and Reanimates and can read again and rejoin the asset chain in the store.



WHY RUBY?

So why Ruby? And why am I rambling on about RFID tags and ton foil hats.

WHY RUBY?

- ▶ Lower Technical debt

Listening to a port spewing forth RFID EPC's and parsing them is a far easier task than writing custom firmware in C for a piece of hardware or connecting with libUSB. The manufacturers are getting better at exposing REST like API's, Web sockets and treating devices as HID.

WHY RUBY?

- ▶ Lower Technical debt
- ▶ Lower barrier for entry

In my field Scientists often know python which is a short jump to Ruby.

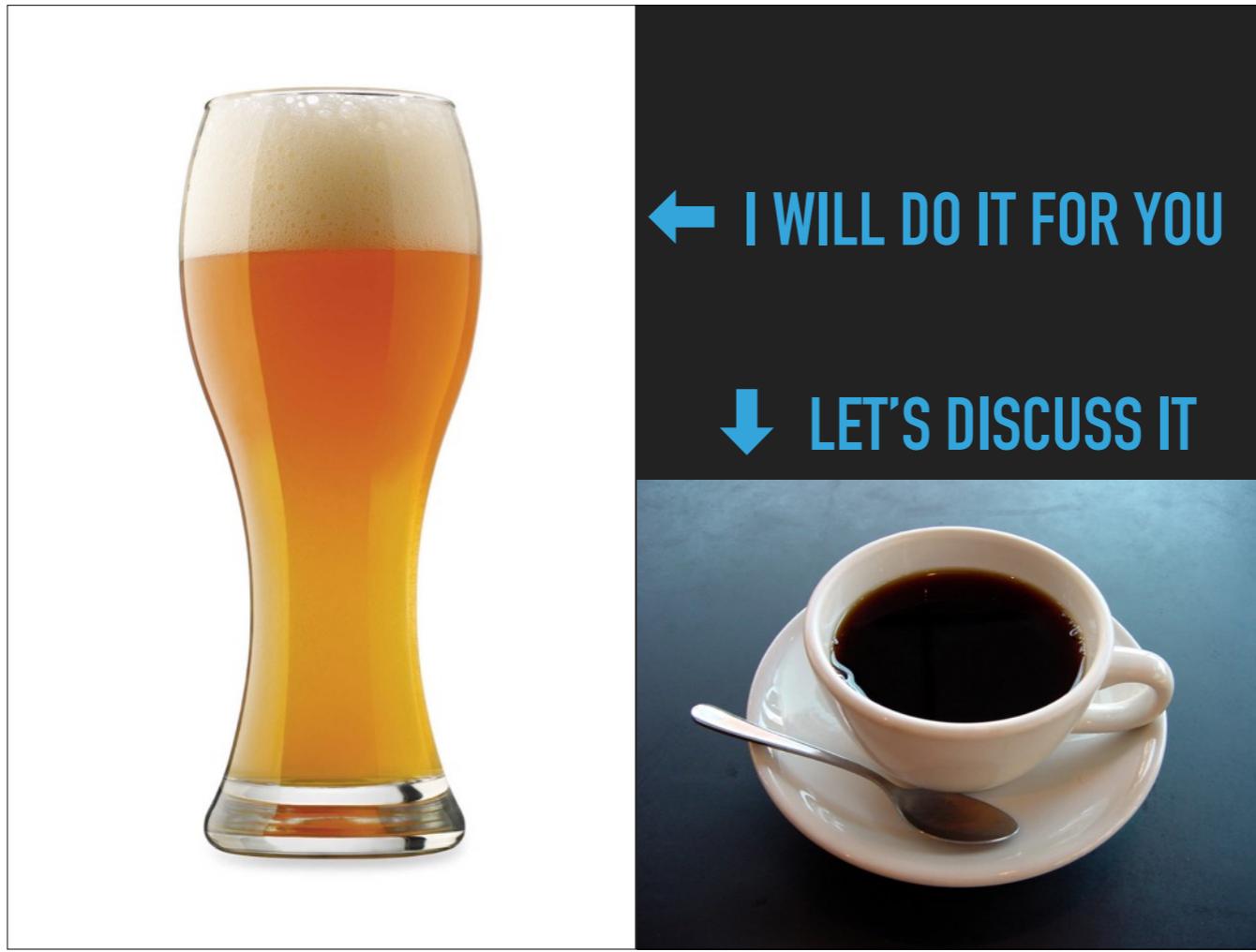
WHY RUBY?

- ▶ Lower Technical debt
- ▶ Lower barrier for entry
- ▶ Ruby makes me happy



Ruby makes me happy. Almost as happy as looking at pictures of cats in tin foil hats

I was a PHP developer for years, AKA, dead inside.



If you want more than a high level overview or help implementing RFID into your project let's get together this evening over coffee. I'll be happy to discuss encryption, tag writing, spoofing EPC's and all that fun stuff. Or buy me beer and i'll do it for you.

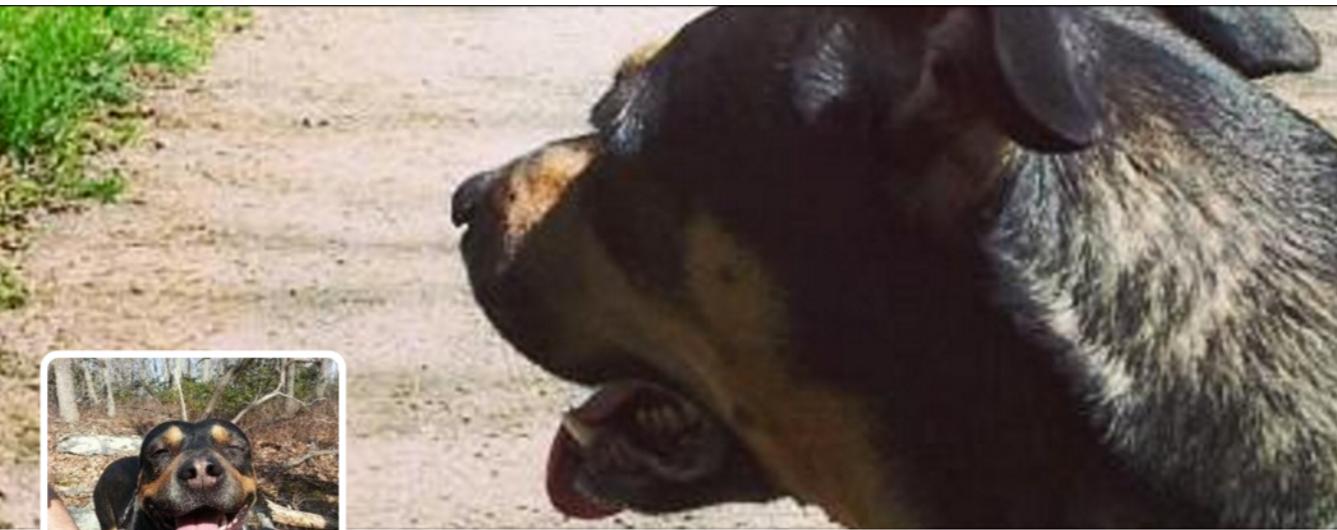
NOT SO PRACTICAL USES



@BETTYPITTWEILER

BETTY

This is betty! [twitter] @bettypittweiler if you love dogs [/twitter]



Betty The Dog
@BettyPittweiler FOLLOWS YOU

I'm a half Pitt / Half Rottweiler who loves hiking, treats and my little rats who I treat like puppies.

📍 Hagerstown, MD

[Tweet to](#) [Message](#)

TWEETS FOLLOWING FOLLOWERS FAVORITES
4 1 1 1

[Tweets](#) [Tweets & replies](#)

 **Betty The Dog Retweeted**
 **Adam Walker** @Acontius · Oct 31
RFID Tag Detected: @BettyPittweiler is inside!

 **Betty The Dog Retweeted**
 **Adam Walker** @Acontius · Oct 31
RFID Tag Detected: @BettyPittweiler is outside!

Betty is on twitter

```

class Betty
  require './setup.rb'
  def initialize(ip='192.168.1.11', port=14150)
    door = TCPSocket.new ip, port
    while rfid = door.gets
      logBetty(rfid.chomp) if rfid.length > 2
    end
  end

  def duration
    str = ""
    TimeDifference.between(@start_time, Time.now).in_general.each {|type, count|
      str << "#{count} #{type}" if count > 0
    }
    str
  end

  def bettyIsOut
    @out = true
    $client.update("@acontius I'm outside please don't forget #{$messages.sample}")
    @start_time = Time.now
  end

  def bettyIsIn
    @out = false
    $client.update("@acontius Thanks for letting in! I was outside for #{duration}!")
  end

  def logBetty(rfid)
    return if rfid != $betty
    @out ? bettyIsIn : bettyIsOut
  end
end

```

explain code and do demo

Explanation for speaker deck: When Betty passes the RFID reader she sends me a tweet letting me know she is out. When she comes in I get a 2nd tweet with the full time of her adventure.

**INTERNET
OF
THINGS**



The whole internet of things sounds somewhat goofy and for me at least the idea of a Smart Fridge seems ridiculous. As my friend Julian Cheal has said “Why should your fridge be internet-connected? Because it could tell you you’ve run out of eggs but it probably doesn’t know that you stopped eating egg months ago”.

No, a smart fridge isn’t for me. What I need is...

[twitter]Julian Cheal <https://github.com/juliancheal> [/twitter]



**MY TRASHCAN IS
SMARTER THAN
YOUR FRIDGE**

**- No One Ever
Until Now**

A smart trashcan. I need a trashcan that knows what and when I throw something out.

TRASHCAN DEMO

After entering in grocery items the smart trash can record me throwing them out and builds a shopping list.

```
def updateFridge(id, barcode)
  require 'rest-client'
  begin
    response = RestClient.get "http://eadata.com/feed/?v=3&keycode=4&mode=json&find=#{barcode}"
    data = JSON.parse(response)
    newitem = data['product']['attributes']['product']
    Fridge.find(id).update(item: newitem, onhand: true)
  rescue
    Fridge.find(id).update(item: 'Item not found')
  end
end

def logtags(speedway, port)
  require 'socket'
  rfid = TCPSocket.new speedway, port
  while line = rfid.gets
    if line.chomp.length > 2
      foundtag = Fridge.where(rfid: line.chomp).first
      foundtag.update(onhand: false) if foundtag
    end
  end
end

App.new.async.logtags('', 14150)
```



If you want to extend this idea we could track who's the most wasteful or not recycling using RFID wristbands. And what is a better way to say I love you to friends and family than to ask them to wear a tracking bracelet!!!

FASHION CONSULTANT

With RFID and Ruby you can have your own personal fashion consultant. How do you know you need a fashion consultant?



You own any of these pants OR you wear kilts and crocs

POSSIBLE USES

- ▶ Can't wear the same clothes twice in a row
- ▶ Clothes should match
- ▶ **Special clothes for special occasions**



Fashion Portal “Fashionista”

Special clothes for special occasions.

I live a rich fantasy life and prefer to have my own theme music depending on what I'm doing.

```
module Fashionista
  class Job < Padrino::Application
    require 'socket'
    require 'audite'
    include SuckerPunch::Job
    workers 2

    def findtag(line)
      tag = Clothing.find_by(rfid: line)
      return 0 if tag && tag.seen > 60.seconds.ago
      tag ? (tag.update(seen: DateTime.now)) : (return 0)
      tag[:rank]
    end

    def playsong(song)
      player = Audite.new
      player.load("#{song}.mp3")
      player.start_stream
    end

    def listen
      rfid = TCPSocket.new '127.0.0.1', 14150
      while line = rfid.gets
        if line.chomp.length > 2
          tag = findtag(line.chomp)
          Job.new.playsong(tag) unless tag == 0
        end
      end
    end
  end
end
```

The code plays a song as I exit my bedroom based on what I am currently wearing.

ALMOST OVER?

I didn't show details about TAG composition and different memory areas, password locking, kill commands, etc. If you want to talk afterwards I'm more than game.

I have one more silly thing to show as a live demo. Let's talk imagination!!!



This was a last minute addition. I kidnapped Coraline Ada Ehmke's teddy bear and held a RFID scavenger hunt at the Marriott where Rubyconf 2015 was held.

Enter Clue

Help Coraline get her favorite bear back before it's too late! Once you find a tag you can scan it directly into the box below and discover your next clue!

Tag:

Submit Clue



SAVEDANA.METALPOLYGLOT.COM

Coraline and a group of people helping here rescued the bear and had a great time doing it.

[twitter] Help Save Dana <http://SAVEDANA.METALPOLYGLOT.COM/> [/twitter]



THANK YOU

[twitter] Thank you #rubyconf for letting me talk! [/twitter]