SharkFest ‘16

Security, the Internet, Failure to Learn Lessons, and Forming an Unstoppable Voltron of Bad Decisions

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Proving Sadness With Math

- Security is terrible
- The Internet is terrible
- People are terrible
- People use the Internet
- Everything is on the Internet now
- By the transitive property, everything is terrible.

- But we have funny pictures from the Internet to make you feel less bad about it.

Voltron

- So… who remembers Voltron?

I Liked Transformers Tho…

- Voltron is a bunch of crummy lion robots
- (Look, it was the 80s, we had toys to sell here people.)
- The lions always get their butts kicked
- Then they team up to make Voltron, the unstoppable giant robot of doom that stomps the aliens
- I think we were supposed to learn teamwork is important?
- How about, when enough little problems gang up, they're almost unbeatable?

How Does A Company Get Owned

- Maybe it's a bug in their web app
- Is it in their own code? Were they just sloppy?
- Is it in Apache/Ngnx/IIS/Other core service?
- Is it a fundamental bug in PHP/Ruby/Etc?
- Is it in the database API?
- Is it in the *bash* interpreter?
- Is it in OpenSSL?

Maybe Not The Server At All

- Maybe an employee got infected on a bad Wi-Fi network
- Or visited an … exciting … site at work and got hit with a browser bug
- Maybe they're important enough to be interesting to a foreign government looking to collect data and were hit with a targeted attack?
- Maybe they're not important, but got owned anyhow because any data has value?
- Maybe it's ransomware looking to extort money?

Maybe Email?

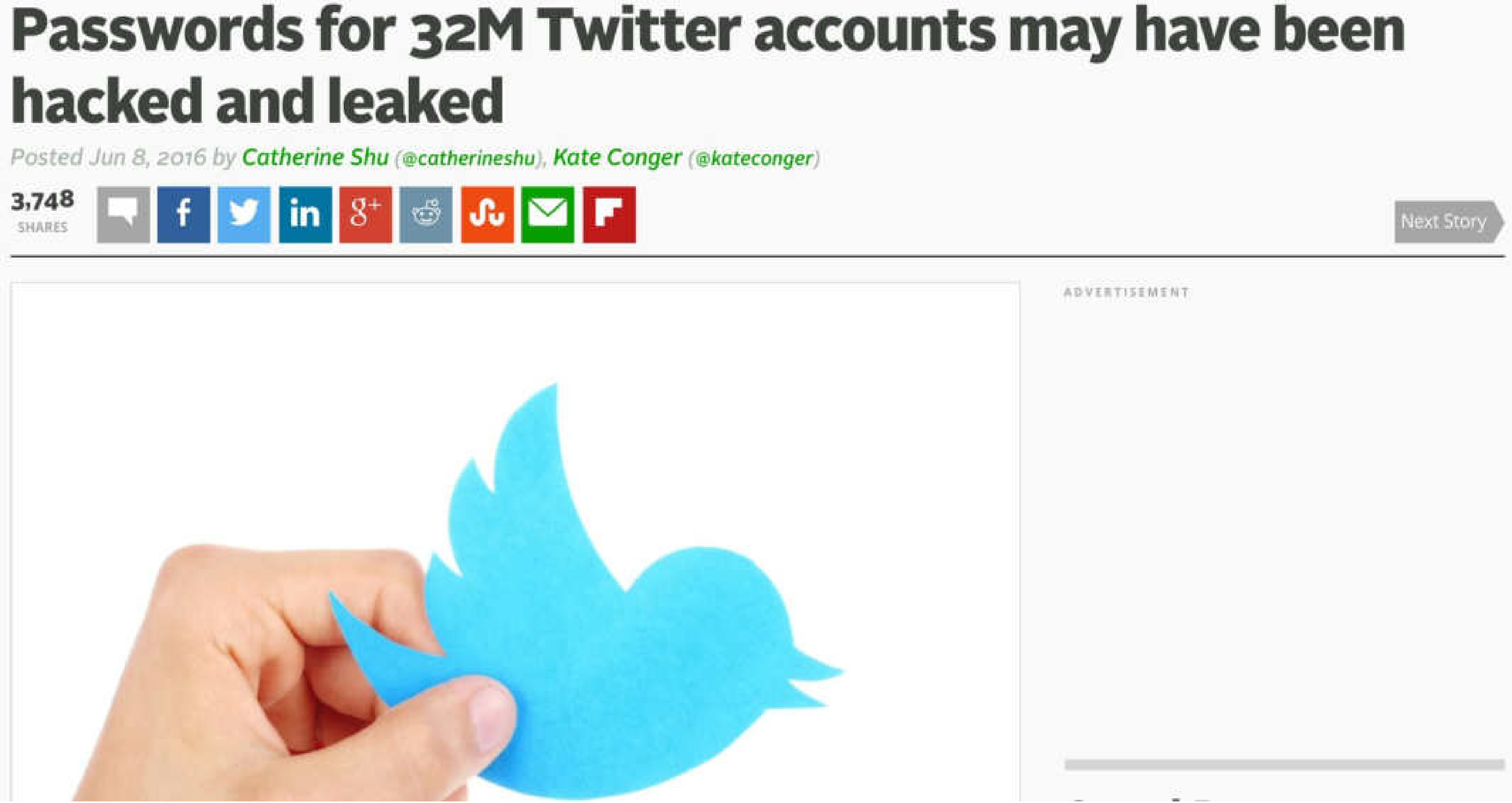
- Maybe it was a bulk phishing attempt
- Maybe it was a targeted phishing attempt
- Bug in PDF?
- Bug in Word?
- Bug in the browser via E-Mail?
- How do you even know?

Or...

- Or maybe one of their employees used the same password at work and on a public site
- Like a dating site
- Or a “dating” site
- And their work email
- How many .gov and .mil addressesses were in the Ashley Madison dump?
- Look, people are dumb

Hacks Are Scary

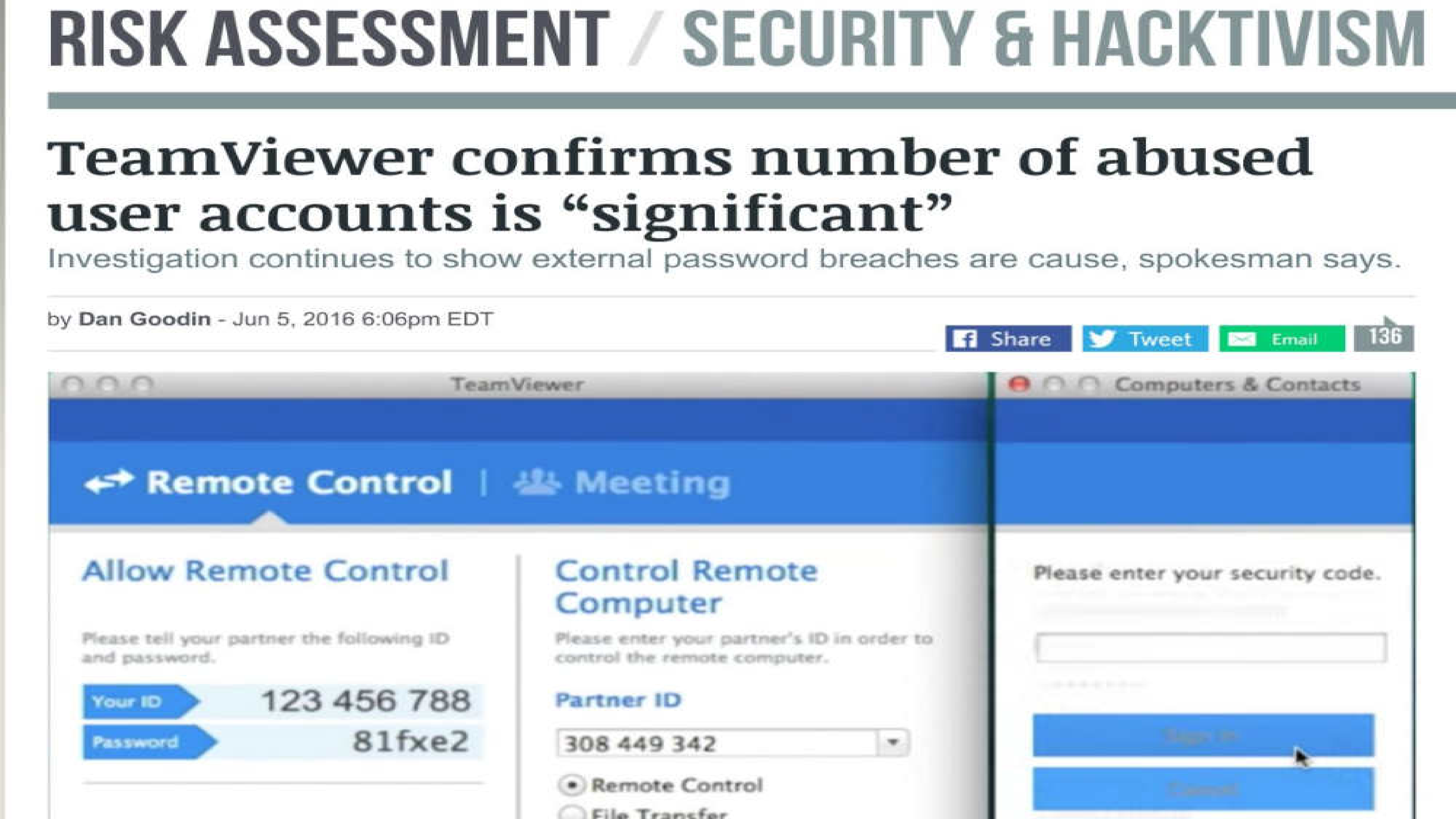
- Some hacks are still curious kids exploring
- Not a bet you can make anymore
- There’s a *lot* of money in crime
- Calling it “cyber” crime and “cyber” theft doesn’t mean it’s not the same people behind it as, you know, *crime*.



Passwords for 32M Twitter accounts may have been hacked and leaked

Posted Jun 8, 2016 by Catherine Shu (@catherineshu), Kate Conger (@kateconger)

3,748 SHARES



RISK ASSESSMENT / SECURITY & HACKTIVISM

TeamViewer confirms number of abused user accounts is "significant"

Investigation continues to show external password breaches are cause, spokesman says.

by **Dan Goodin** - Jun 5, 2016 6:06pm EDT

Allow Remote Control

Please tell your partner the following ID and password.

Your ID 123 456 788

Password 81fxe2

Control Remote Computer

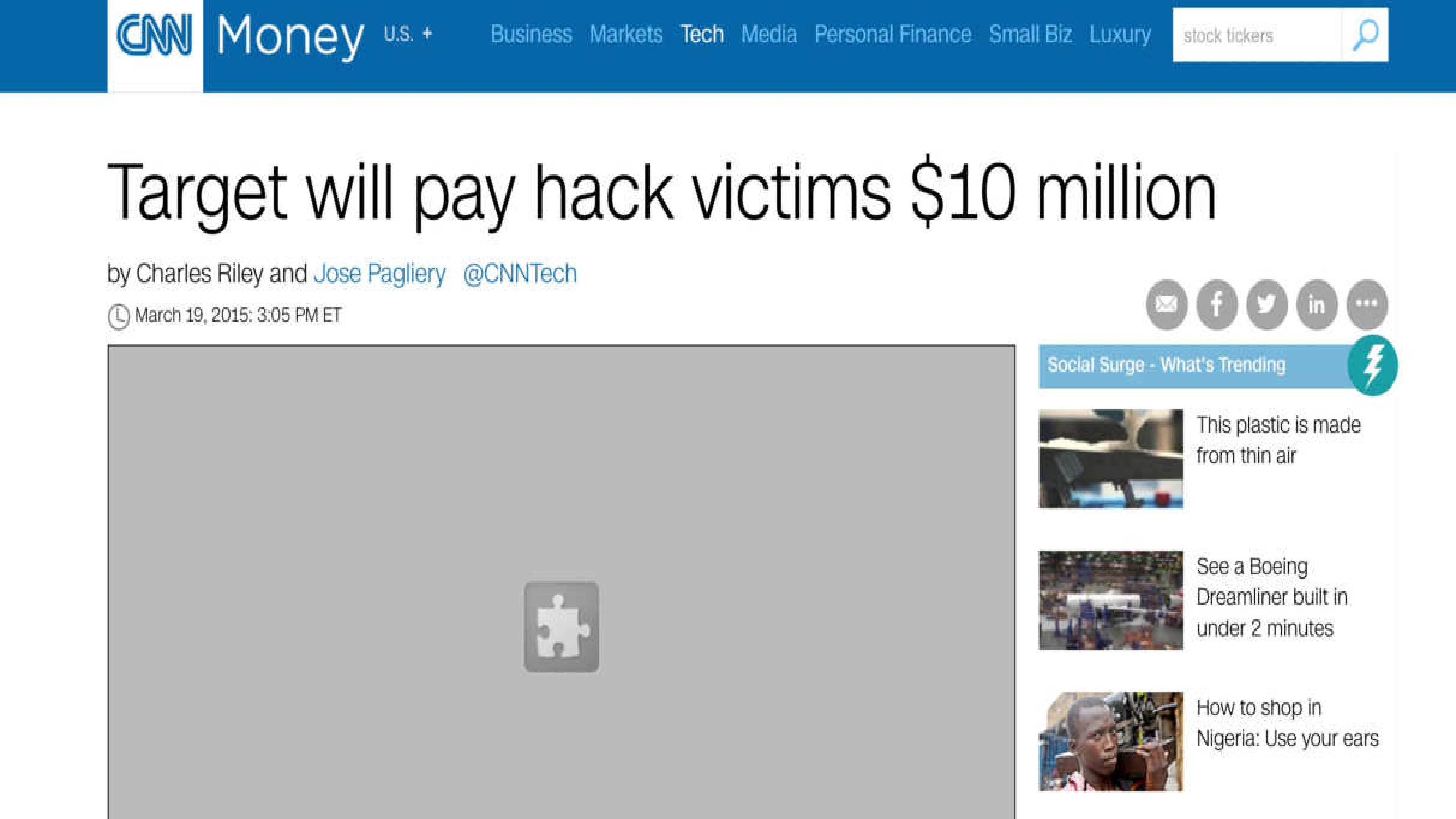
Please enter your partner's ID in order to control the remote computer.

Partner ID 308 449 342

● Remote Control

○ File Transfer

Please enter your security code.



Target will pay hack victims $10 million

by Charles Riley and Jose Pagliery @CNNTech

March 19, 2015: 3:05 PM ET

This plastic is made from thin air

See a Boeing Dreamliner built in under 2 minutes

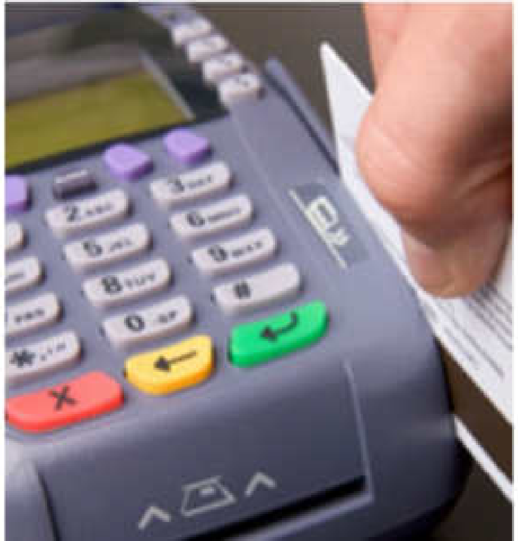
How to shop in Nigeria: Use your ears

Heartland Payment Systems, Forcht Bank Discover Data Breaches

Both Companies Might be Victims of Larger Fraud Schemes

Linda McGlasson • January 21, 2009

Twitter Facebook in LinkedIn ★ Credit Eligible i Get Permission



Heartland Payment Systems, the sixth-largest payments processor in the U.S., announced Monday that its processing systems were breached in 2008, exposing an undetermined number of consumers to potential fraud.

Meanwhile, Forcht Bank, one of the 10 largest banks in Kentucky, told its customers it would begin reissuing 8,500 debit cards after being informed by its own card processor of a possible breach.

GET DAILY EMAI

Covering topics in r
fraud, and informat

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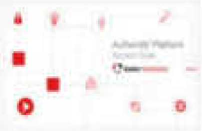
RESOURCES



Home / Security

Internet-connected Hello Barbie doll can be hacked

The iconic toy becomes a connected device, and promptly gets pegged for security issues.

/article/3082333/android/report-apple-to-announce-imessage-for-android-at-wwdc.html

Forbes / Tech

JUL 27, 2015 @ 01:31 PM 6,055 VIEWS

Five Lessons On The 'Security Of Things' From The Jeep Cherokee Hack

John Villasenor
CONTRIBUTOR
I write about the intersection of technology, policy and the

Last week, *Wired* published an account describing how two security researchers, Charlie Miller and Chris Valasek, were able to wirelessly hack into a Jeep Cherokee, first taking control of the entertainment system and windshield wipers, and then disabling the accelerator. Andy Greenberg, the *Wired* writer who was at the wheel as the self-described "digital crash test dummy" explained what happened next:

How Did We Get Here

- How did things get this bad?

We Have A History

- We have a history of sucking at security.
- We sucked at it in the 80s
- We sucked at it in the 90s
- We sucked at it in the 00s? Naughties? Aughts? … The 2000s. We sucked at it then.
- Do you think we suddenly learned how to do security properly in 2016? Of course we didn't. That's a silly idea.

The 80’s

- We didn’t know security, but we knew how to rock.
- Encryption was computationally expensive, weakened by the government export rules
- Telnet was good enough for everyone
- RSH seemed like a real good idea. Just set what hostnames are allowed! That’s great! (hint: usually ‘*’)
- Shared-media Ethernet (or TokenRing if you were really special)

The 90's

- Switched networks are a good thing
- Encryption is still difficult and regulated.
- Who remembers the export-legal versions of Netscape?
- SSL happens, sometimes
- SSH happens, sometimes
- Dial-up still sucks, but it sucks at 56k
- How many floppies is that update?

The 2000’s

- I tried to come up with something funny about the 2000s but failed.
- TokenRing went away, mostly, unless you work at IBM.
- Windows XP, the One True Windows version

Now

- We understand encryption? I guess?
- Encryption is still really hard to do right. And we *very often* do it completely wrong.
- Now we're starting a whole new war on regulating it
- Guess what Wi-Fi is? Shared media networking again.
- *Everything* is a computer.
- How do I update my light bulbs?
- *Why* do I have to update my light bulbs.

My Favorite Topic!

- You've probably heard this before
- You may have even heard me talk about this before
- Just because it's old doesn't mean we've gotten smarter

Wi-Fi Is Like Time Travel

- Using Wi-Fi is a lot like going back in time to the 80s

MEAN Time Travel

- Except it’s not hippy friendly time travel
- You get to bring back all the advanced modern attacks and weaponry

Shared Media

- Open Wi-Fi networks are shared media
- Like, an Ethernet hub.
- What protects you from your fellow users on Wi-Fi?
- ***Basically Nothing***
- Sniffing, injecting, sequence number guessing, hijacking the router, ARP poisoning…
- Lets party like it's 1993!

Hijacking A Client The Old-School Way

- What protects a TCP connection from stream hijacking?
- Sequence and Ack numbers
- What can we see for every connection on open Wi-Fi?
- *Seq/Ack*
- What uses a lot of unencrypted connections and loads arbitrary content?

Hijack Browser

- Trivial to hijack the browser
- Inject malicious code into browser sessions while user is on open network
- Set cache controls to keep the hostile page saved forever
- Trigger exploit when victim goes back to their company and loads the page again
- All the corporate defenses are useless when the victim brings it in as a cached page

WEP - It’s Like Encryption, But Not

- Let’s make fun of WEP! (Again!) (Always!)
- It’s like they read how to misuse an algorithm
- And specifically implemented it to expose every possible flaw.
- So do we still have to talk about WEP?
- Yep. Because what uses WEP? Stuff that hasn’t been updated in the last decade.
- What doesn’t get updated?

You Can’t Fix Everything

- What can’t get updated?
- Stuff in planes. Probably bad.
- Power plants. Probably bad.
- Rando core infrastructure. Probably bad.
- Medical equipment. *Really* bad.

Worst Email I’ve Ever Gotten

“Customer needs assistance connecting an IV Drug Pump to a WEP network.”

WPA

- “But I’m fine”, I claim to hear you say, for the sake of a clever presentation. “**MY** coffee shop uses WPA!”
- What do you need to know to impersonate a network?
  1. The SSID
  2. The WPA key
- Where could we ever find the WPA key?
- Oh right. That wall over there has it.
- *This even happens at hard-core security conferences, and it’s hilarious to me.*

Open Wi-Fi?

- Open Wi-Fi is a cesspool of other people's infected machines
- WPA with a public key is basically Open Wi-Fi
- In the ***best*** case
- Worst case? Actively hostile network attempts to compromise your traffic and your system
- Especially at airports (where business people travel), conferences (where people take work laptops), etc
- How about in-flight Wi-Fi?

But Who Would Use Open Wi-Fi

- But who would blindly use open Wi-Fi at this point?
- Your phone
- All the time
- *All* the time
- More than happy to connect to any open Wi-Fi network with a name you've connected to before
- Sometimes even networks you've never used deliberately (pre-loaded like ATTWifi)

Impersonating Networks

- Same fun attack as a decade ago
- Wi-Fi never changes
- “Karma” attack
- Probe contains network you want to join
- “Yes, of course I’m that network. I’m also that network over there, and that one, and the fourth one, too. Please talk to me. I’m so lonely.”

No Way To Know

- Not entirely the clients fault
- How do you know what’s legit?
- A network is a name (ESSID)
- And the encryption options (usually Open)
- Any network with the same ESSID is considered to be the same network

Now I Control Your Traffic

- Once someone gets you to connect to their AP…
- They control your routing
- They control your DNS
- They control your ports
- They see all unencrypted traffic
- They see encrypted traffic, and you hope they can't do anything about that
- They are, basically, your ISP

What’s So Bad?

- Your phone is an embedded computer
- “Embedded.” Android is Linux. You can put bash on it. It’s a Linux PC that’s always online. iOS is based on BSD.
- And it knows where you are
- And who you talk to
- And shows you content (like ads) …

… From random sources and networks.

Let’s Make Fun Of Phones!

- I used to work for a company making Android phones
- My preferred platform is Android
- I still love to make fun of Android
- Android vs Apple is a political argument
- That said, Apple probably does more things right for security right now, if you had to pick on that alone

Vulnerabilities Gonna Vuln

- Everyone is going to have vulnerabilities
- *Everyone*
- Everyone is going to have *high profile device killing and crippling vulnerabilities*
- The real question is, *what happens when the poop hits the fan*

How Do You Fix It

- So someone just found a crippling vulnerability in your phone OS
- Let’s say, one that you can trigger with manipulated traffic
- Examples:
  IOS: root from web (rootmyiphone.com)
  Android: Arbitrary code execution from JS, Stagefright

Doing It Right

- Apple releases updates universally to all iPhone devices (unless your device is too old. Of course you have $800 burning a hole in your pocket, right?)
- Google releases updates to the Nexus phones world-wide
- Google releases fixes to partner companies
- Finally, Google updates the AOSP source code repo if the exploit is in public code

Doing It Wrong

- Every Android vendor has to patch their own device
- Every vendor typically makes 4 to 10 devices per year
- Each device typically has a 200 person team
- Each device has custom kernel and userspace modifications on top of stock Android
- Plus vendors love to re-skin the entire device to encourage user lock-in
- Do you think they keep 1000-2000 developers around for the 2-4 year lifespan of 15-40 devices?

No, They Don’t

- No, they don’t
- Which means they have to go take people off a new phone dev cycle
- Find the old code
- Find the old build environment
- Backport the fixes
- Decide this is all worth losing money by not telling the user to just buy new HW
- At least it’s fixed!

Now Wait Another 6 Months

- Basically any phone sold direct from a carrier (except iPhone, because Apple is a pretty pretty princess with a really big baseball bat with nails in it) has carrier-controlled firmware
- Carrier controls OTAs
- Stocks their adware and crapware and custom apps
- Have their own homologation and approval process
- Can take 6 months or more

Yep.

- So a critical bug, like say, sending someone a malicious SMS can execute code (like, Stagefright?) hits
- Public patches land showing exactly how to execute it (nothing better for reversing an exploit than a patch)
- 6 months later, ***some*** phones get an update. The rest might in another 2 or 3 months.
- Most phones see one or two updates, ever
- Even fewer see an upgrade to the latest OS revision

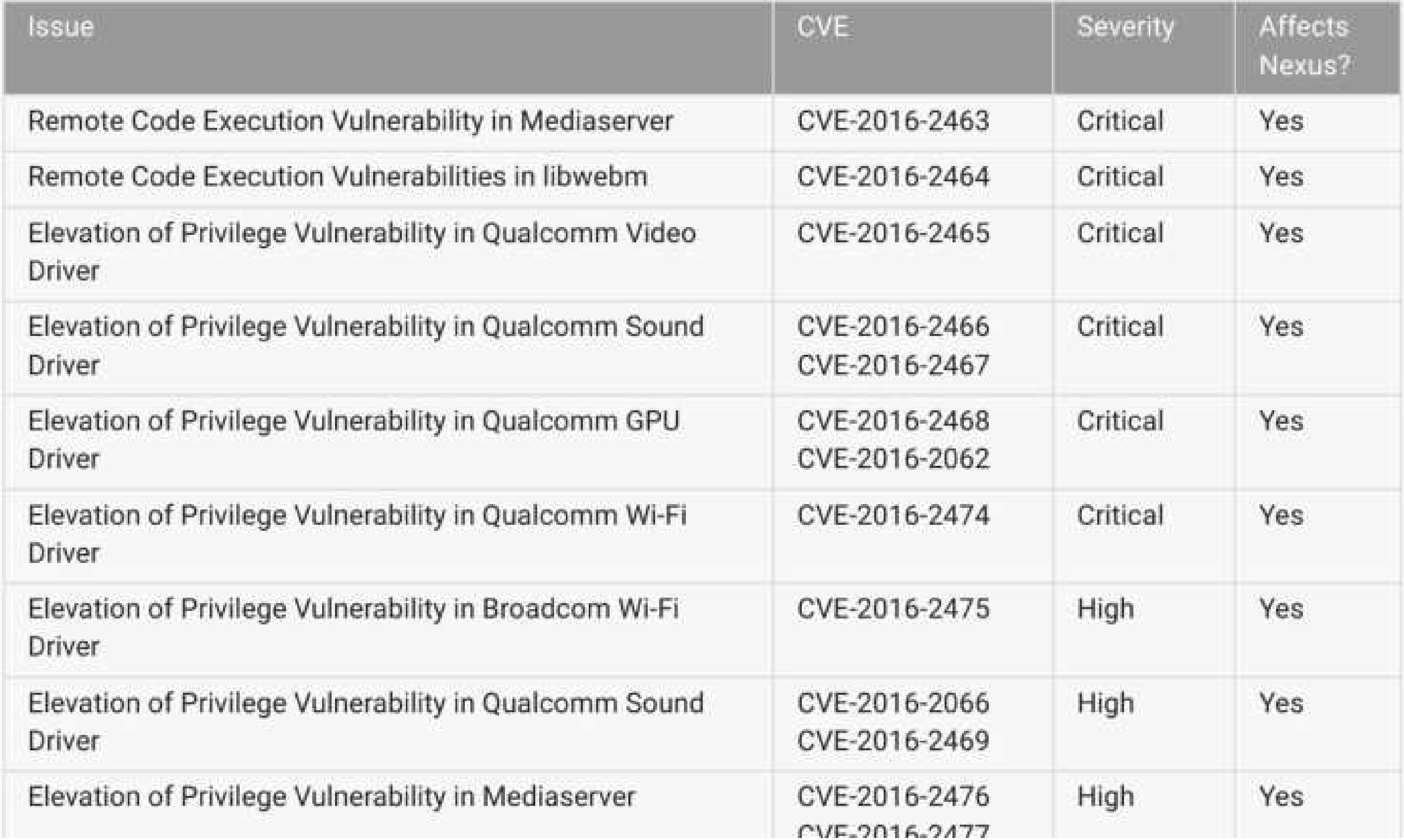
Baby Steps

- Google knows this is a terrible problem
- Fixing it by taking power away from carriers and phone vendors, naming and shaming, and splitting up the codebase
- Android 5 makes web browser core updateable, Android 6 revamps permissions and makes other core components updateable
- Too bad only about 8% of devices have Android 6 after almost a *year*.

Who Has The June Update?

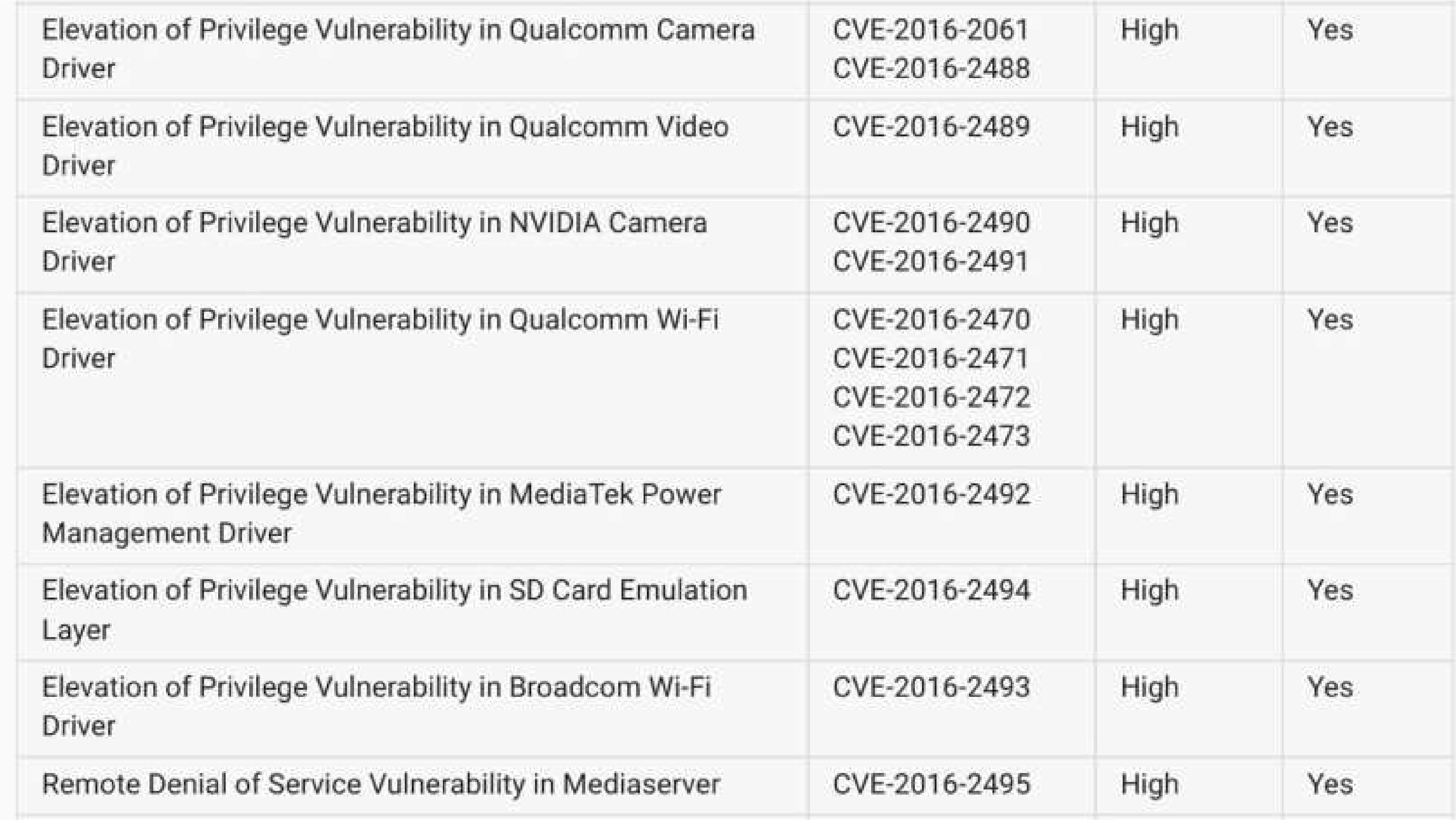
- Google just dropped the June update last week
- Who has it yet?
- How important is it?

Oh.



Issue	CVE	Severity	Affects Nexus?
Remote Code Execution Vulnerability in Mediaserver	CVE-2016-2463	Critical	Yes
Remote Code Execution Vulnerabilities in libwebm	CVE-2016-2464	Critical	Yes
Elevation of Privilege Vulnerability in Qualcomm Video Driver	CVE-2016-2465	Critical	Yes
Elevation of Privilege Vulnerability in Qualcomm Sound Driver	CVE-2016-2466 CVE-2016-2467	Critical	Yes
Elevation of Privilege Vulnerability in Qualcomm GPU Driver	CVE-2016-2468 CVE-2016-2062	Critical	Yes
Elevation of Privilege Vulnerability in Qualcomm Wi-Fi Driver	CVE-2016-2474	Critical	Yes
Elevation of Privilege Vulnerability in Broadcom Wi-Fi Driver	CVE-2016-2475	High	Yes
Elevation of Privilege Vulnerability in Qualcomm Sound Driver	CVE-2016-2066 CVE-2016-2469	High	Yes
Elevation of Privilege Vulnerability in Mediaserver	CVE-2016-2476 CVE-2016-2477	High	Yes

Oh, no.



Elevation of Privilege Vulnerability in Qualcomm Camera Driver	CVE-2016-2061 CVE-2016-2488	High	Yes
Elevation of Privilege Vulnerability in Qualcomm Video Driver	CVE-2016-2489	High	Yes
Elevation of Privilege Vulnerability in NVIDIA Camera Driver	CVE-2016-2490 CVE-2016-2491	High	Yes
Elevation of Privilege Vulnerability in Qualcomm Wi-Fi Driver	CVE-2016-2470 CVE-2016-2471 CVE-2016-2472 CVE-2016-2473	High	Yes
Elevation of Privilege Vulnerability in MediaTek Power Management Driver	CVE-2016-2492	High	Yes
Elevation of Privilege Vulnerability in SD Card Emulation Layer	CVE-2016-2494	High	Yes
Elevation of Privilege Vulnerability in Broadcom Wi-Fi Driver	CVE-2016-2493	High	Yes
Remote Denial of Service Vulnerability in Mediaserver	CVE-2016-2495	High	Yes

And This Isn’t Even The Problem

- This isn’t even the real problem
- You’re going to have vulns
- These are ***the ones that were reported and fixed***
- Never mind the ones that *aren’t* disclosed
- The *real* problem is that everyone in the room doesn’t have this fix already
- And a significant percentage *never will*
- If you don’t have a Nexus or this years flagship, you may never see these fixes. Or next months. Etc.

What Else Can We Do To Phones?

- Ads use webviews because it's easy
- Webviews can connect javascript and native java
- Ads turn on the JS/Java bridge so they can scrape more info out of your phone. Because ad companies are lovely like that.
- Java has introspection
- Java can run native commands via System.exec()
- See where we're going?
- Hijack an ad, run a command.

Open Wi-Fi

- So still think open Wi-Fi injecting malicious code into phones isn't a big deal?
- Hard to tell how many malicious networks are actually out there
- Can snag a phone with a few packets
- Can poison existing HTTP sessions with a few packets
- Trivial to intercept an ad and wrap it in hostile JS
- Maybe some apps are fixed, but are *all* your apps fixed?

Updates Are Hard, Yo

- Yeah, I get it, updates are hard
- Not like a phone is by nature always online
- … Oh. But it is.
- It’s so bad that Congress is interviewing phone companies about their update processes
- You know. Congress. Who does all the useful tech stuff? That Congress? It’s fine. They understand.
- Good thing we don’t have any other products which are online but even harder to update...

You Can’t Have A Nice Internet Of Things

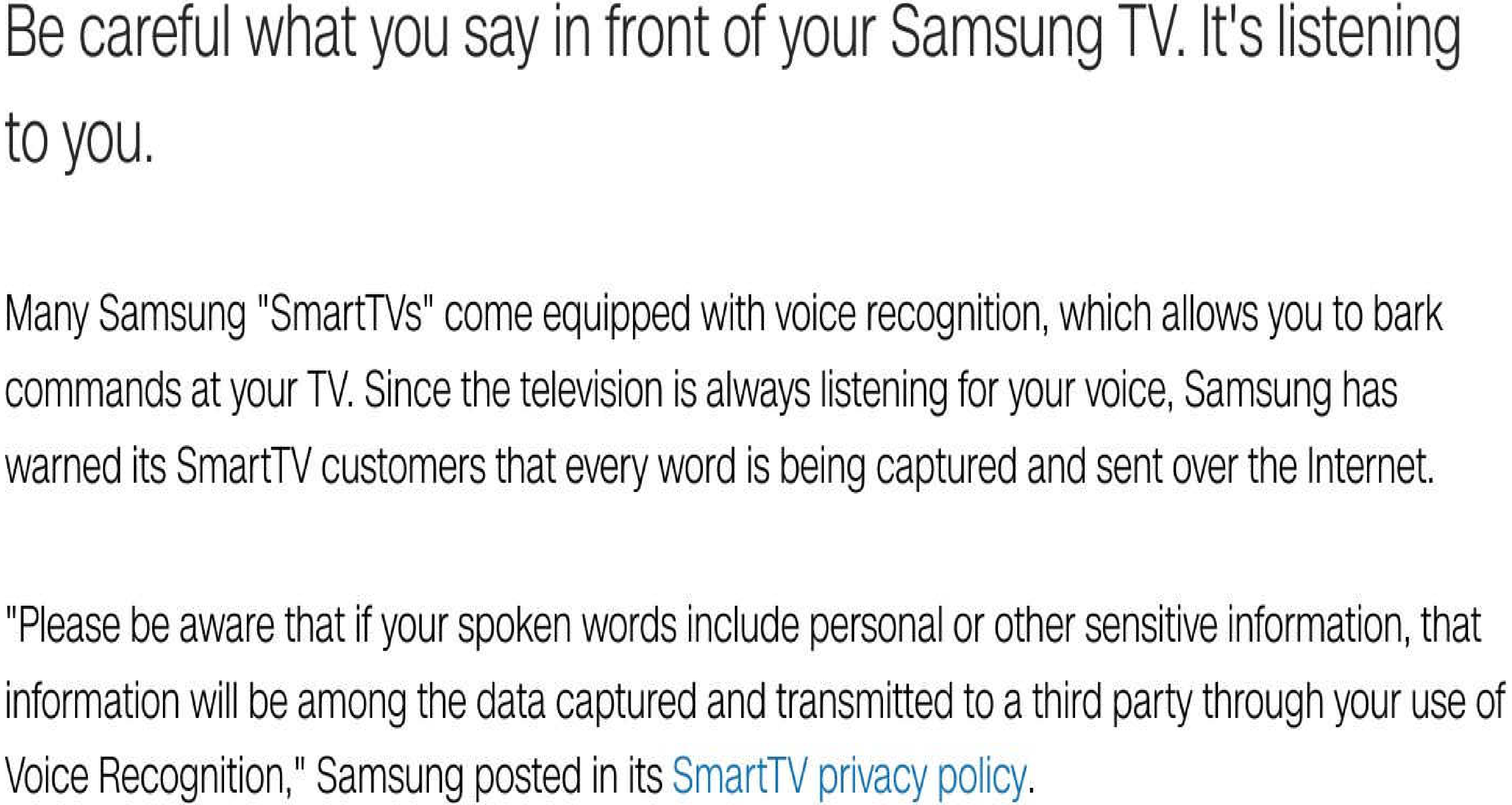
- So, lets make fun of the Internet Of Things!
- This is why you can’t have nice things, ever

Egg Crates? Light Bulbs? Nah.

- The low hanging easy targets are the nonsense products like IOT egg crates
- Why does the Internet need to know how many eggs I have?
- Light bulbs are a little more interesting
- But have you tried to buy a TV that doesn't listen to the whole room?
- Why does a fridge run Android?
- How do you update this nonsense anyhow?

Security Bugs? In *My* TV?

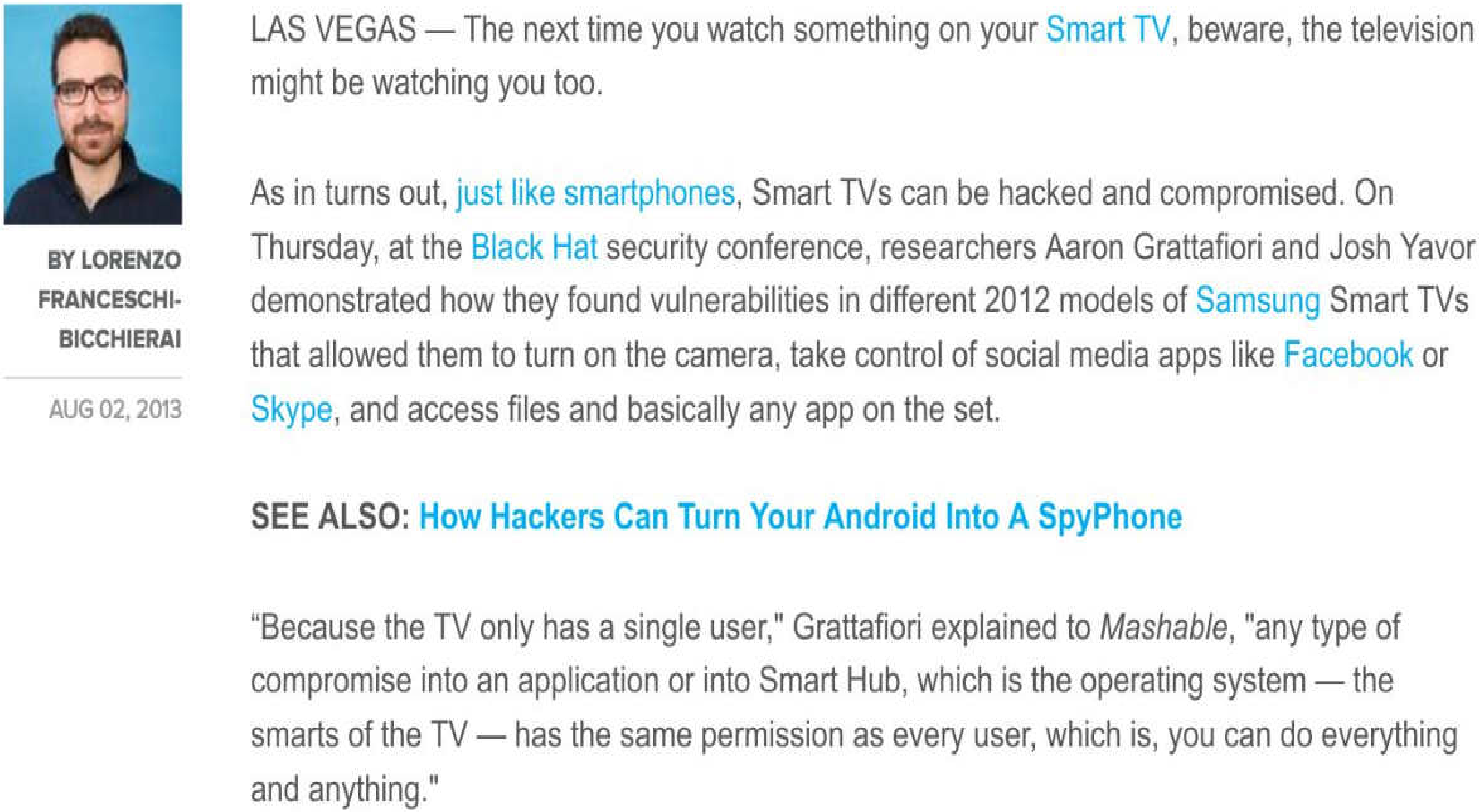
- It's more likely than you think!
- Smart TVs are just Android with a big screen, usually
- Android that doesn't get a lot of updates
- And is always online
- And records what you say to try to listen to voice commands
- And sends it… somewhere… on the Internet
- All. The. Time.



Be careful what you say in front of your Samsung TV. It's listening to you.

Many Samsung "SmartTVs" come equipped with voice recognition, which allows you to bark commands at your TV. Since the television is always listening for your voice, Samsung has warned its SmartTV customers that every word is being captured and sent over the Internet.

"Please be aware that if your spoken words include personal or other sensitive information, that information will be among the data captured and transmitted to a third party through your use of Voice Recognition," Samsung posted in its SmartTV privacy policy.



BY LORENZO FRANCESCHI-BICCHIERAI

AUG 02, 2013

LAS VEGAS — The next time you watch something on your Smart TV, beware, the television might be watching you too.

As in turns out, just like smartphones, Smart TVs can be hacked and compromised. On Thursday, at the Black Hat security conference, researchers Aaron Grattafiori and Josh Yavor demonstrated how they found vulnerabilities in different 2012 models of Samsung Smart TVs that allowed them to turn on the camera, take control of social media apps like Facebook or Skype, and access files and basically any app on the set.

SEE ALSO: How Hackers Can Turn Your Android Into A SpyPhone

“Because the TV only has a single user," Grattafiori explained to *Mashable*, "any type of compromise into an application or into Smart Hub, which is the operating system — the smarts of the TV — has the same permission as every user, which is, you can do everything and anything."

This Could Be You

- Think you're not a target?
- Work for a tech company?
- Have a government clearance?
- Everyone with a clearance already has had all their info stolen via the OPM hack
- Ever bring work home?
- Maybe it's a real threat. Maybe it's time for a tin foil hat. Don't use aluminum. That's how they get you. Has to be tin.

But Back To IOT

- Sorry, we were making fun of IOT.
- Wi-Fi is hard
  - More expensive to talk to
  - Requires more processing
  - Requires more battery
  - Harder to set up
- So we'll use our own protocol!
- Now we have z-wave. And zigbee. And wink. And brillo. And apple home. And random ISM radio. And…
- And then they bridge to Wi-Fi anyhow!

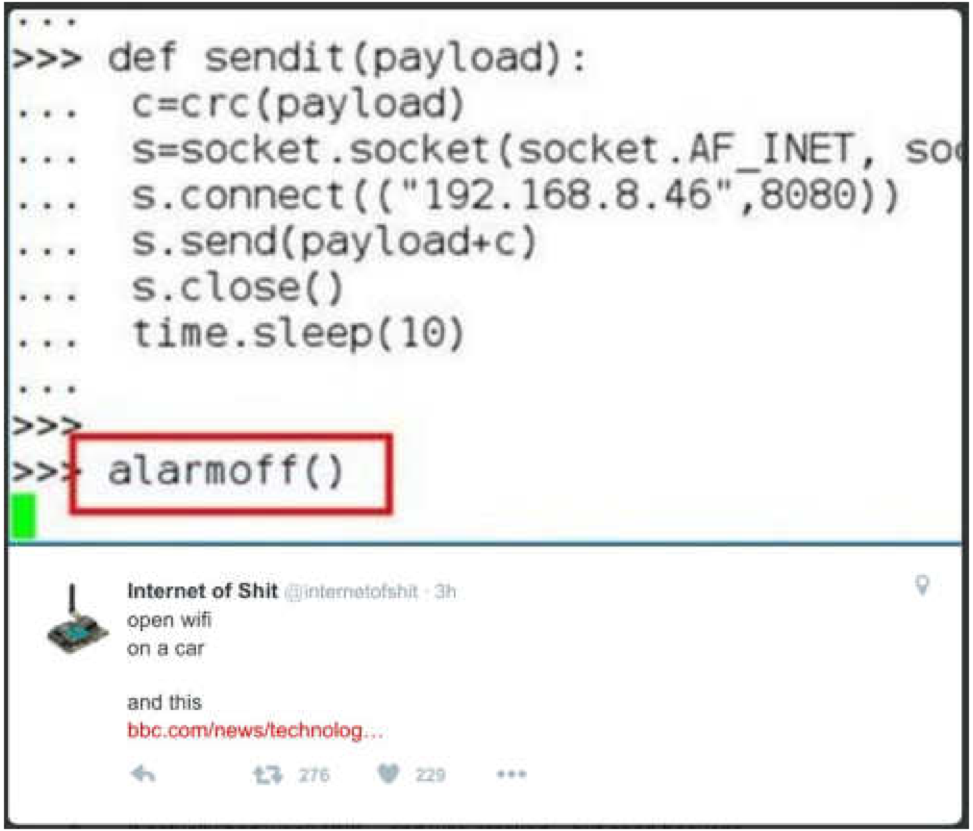
No-One Wants To Interoperate

- The IOT market is a bunch of balkanized one-offs
- Nothing works with anything else
- Deliberately - why have a way for someone to pick something that isn’t your product and accessories?
- No central repository of expertise
- No institutional understanding of security, and no institution to understand it
- Developing hardware like it’s a website with fast integration, only, it’s hardware, so it isn’t.

Race To The Bottom

- Consumer gadgets are cheap
- A $0.005 vs $0.01 component actually matters
- Do you think they're going to do a very good job on security when they're pumping these things out?
- Who wrote the software to connect to your phone/pc/fridge/child/dog
- Did *they* know what they were doing?
- Many companies getting into "Internet All The Things" aren't tech companies at all

I’d Like To Wi-Fi My Car, Please?



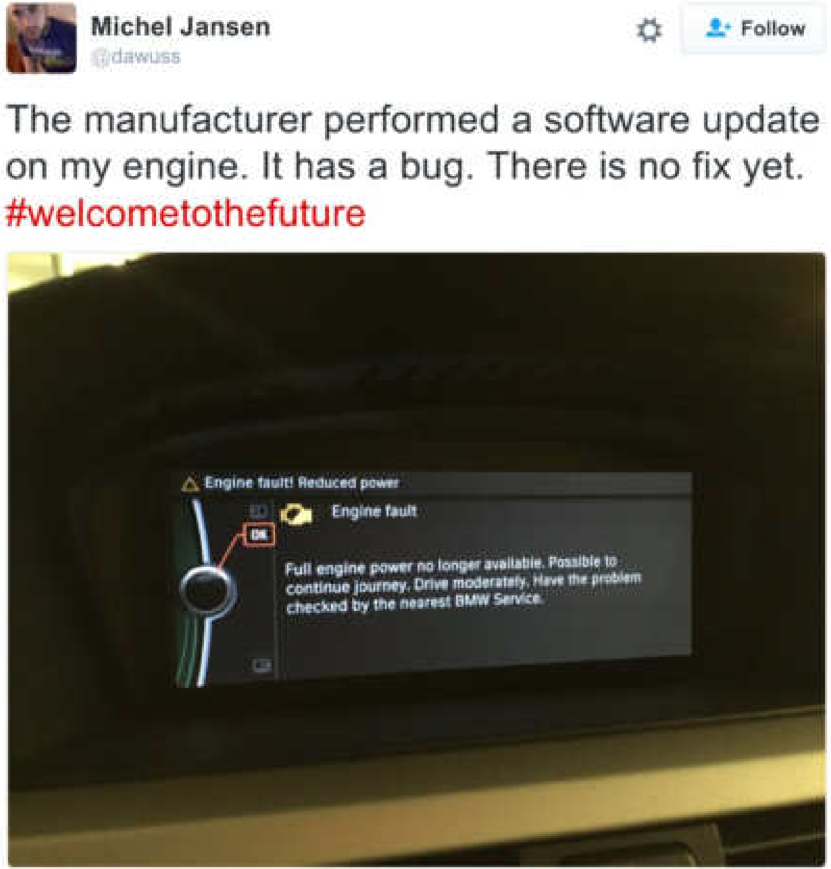
```
...
>>> def sendit(payload):
...   c=crc(payload)
...   s=socket.socket(socket.AF_INET, so
...   s.connect(("192.168.8.46",8080))
...   s.send(payload+c)
...   s.close()
...   time.sleep(10)
...
>>>
>>> alarmoff()
```

Internet of Shit @internetofshit · 3h

open wifi
on a car

and this
bbc.com/news/technolog...

It’s The Future!



Michel Jansen
@dawuss

The manufacturer performed a software update on my engine. It has a bug. There is no fix yet. #welcometothefuture

Engine fault! Reduced power

Engine fault

Full engine power no longer available. Possible to continue journey. Drive moderately. Have the problem checked by the nearest BMW Service.

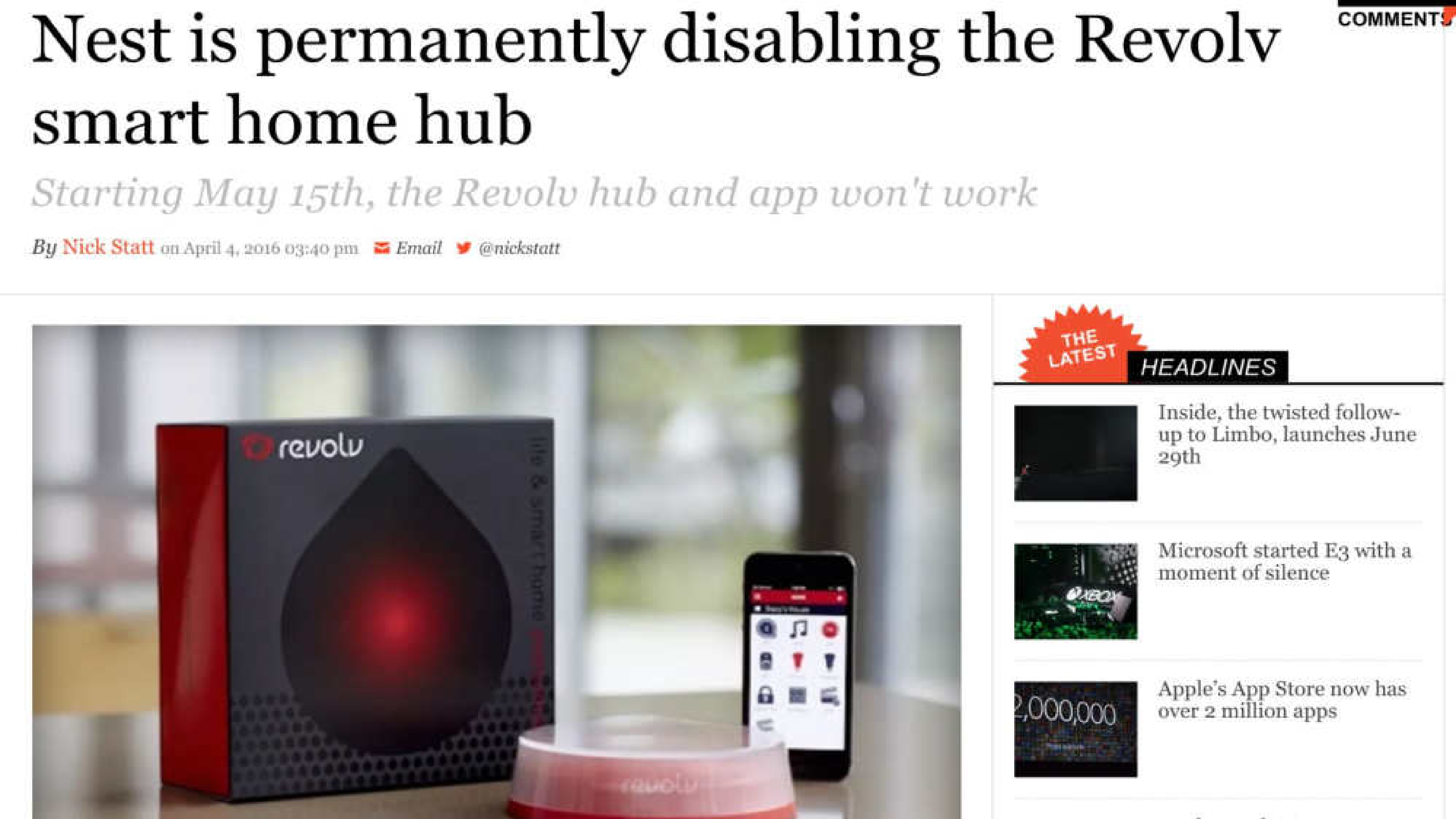
Defending Against Physical

- Another problem is defending from physical attackers
- If you store your key in your device, someone will find it, eventually
- Things like gaming consoles use expensive dedicated TPM devices to protect signing keys to authenticate data
- Your lightbulb wasn't designed by Microsoft or Sony.

- 9F 55 95 F1 02 57 C8 A4 69 CB F4 2B C9 3F EE 31

Consumer Un-Friendly

- IOT is so new it's mostly young companies
- Who have a habit of not sticking around
- How often do you change major appliances in your house?
- Tech moves fast. Appliances and cars do not.
- So what happens in 3 years if WPA gets cracked and your dishwasher, fridge, and toilet have to be replaced?
- Or the company shuts down the servers required to use them because it's no longer profitable?



COMMENTS

Nest is permanently disabling the Revolv smart home hub

Starting May 15th, the Revolv hub and app won't work

By Nick Statt on April 4, 2016 03:40 pm Email @nickstatt

THE LATEST HEADLINES

Inside, the twisted follow-up to Limbo, launches June 29th

Microsoft started E3 with a moment of silence

Apple's App Store now has over 2 million apps

DMCA To The Non-Rescue

- Maybe someone will hack a custom firmware
- Not that this helps anyone but the geeks
- Except you can't, because it's all locked behind DRM
- And the DMCA says you can't hack that even when the company goes out of business
- So we're stuck with insecure stuff, in our houses, on the Internet.
- Well, until it stops working.
- Great!

More Than Home

- Let’s be honest, messing with the lights in someones home is obnoxious
- But it’s probably not the end of the world
- … Unless, of course, someone figures out how to make a worm that shuts down the heat in every house using some popular home thermostat… err…
- But, do you think that industrial systems are any more secure?

The Worst Of All Options

- Industrial control systems don’t typically update
- Power plants still run Win 3.1. Or 95. Or XP. Whatever was around when they were built.
- Would *you* be willing to explain why the metropolitan power grid went down when you updated Win2k?
- Assuming it’s even *possible* to update the systems and they aren’t linked to specific behavior of deprecated platforms!

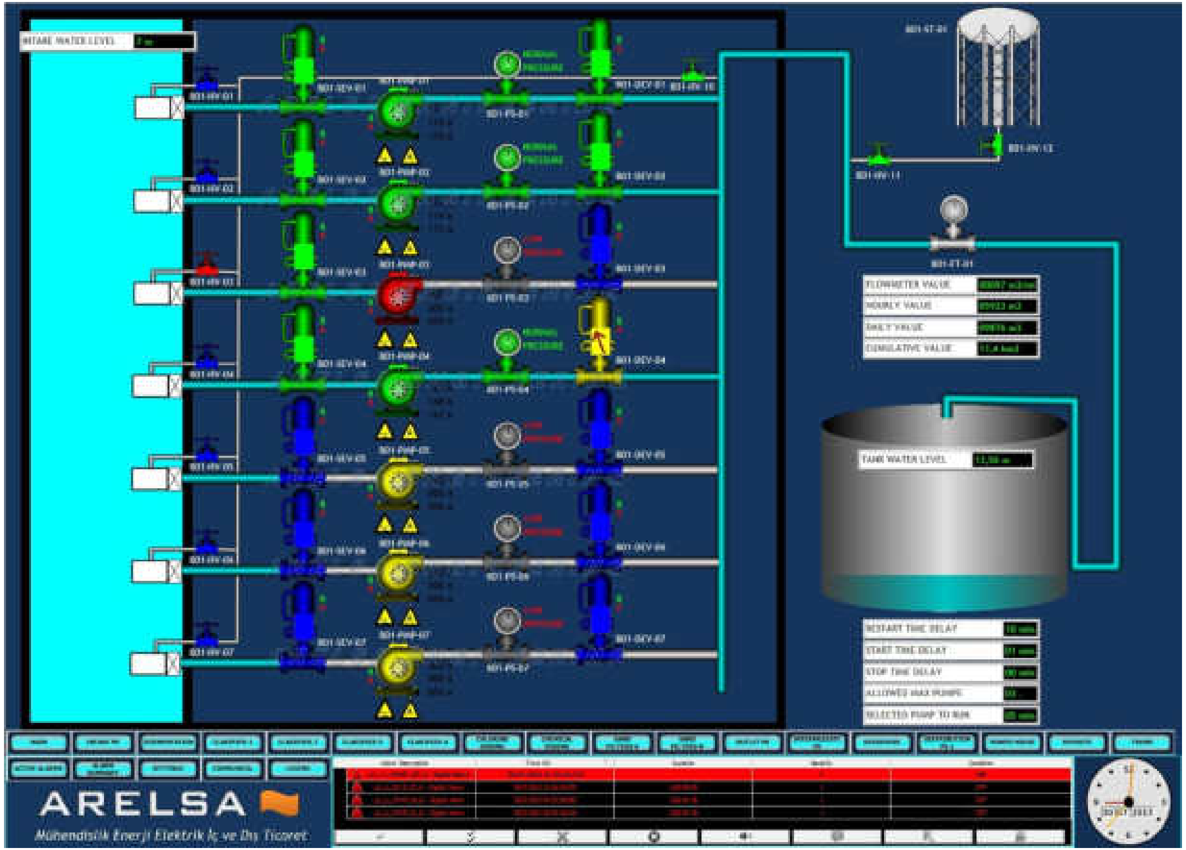
But They’re Not Online

- But it’s fine! They’re not online!
- Until someone decides they need to add Wi-Fi to display something on a tablet
- Or the new cabling guys come in and neaten up the old network and consolidate
- Or they just set up VNC on the control PCs
- Or they’re just ignorant / lazy / dumb

There’s A Search Engine

- There’s a search engine for control systems
- And webcams
- And security systems
- And baby monitors
- And elevators
- http://shodan.io

The Internet Of Industry



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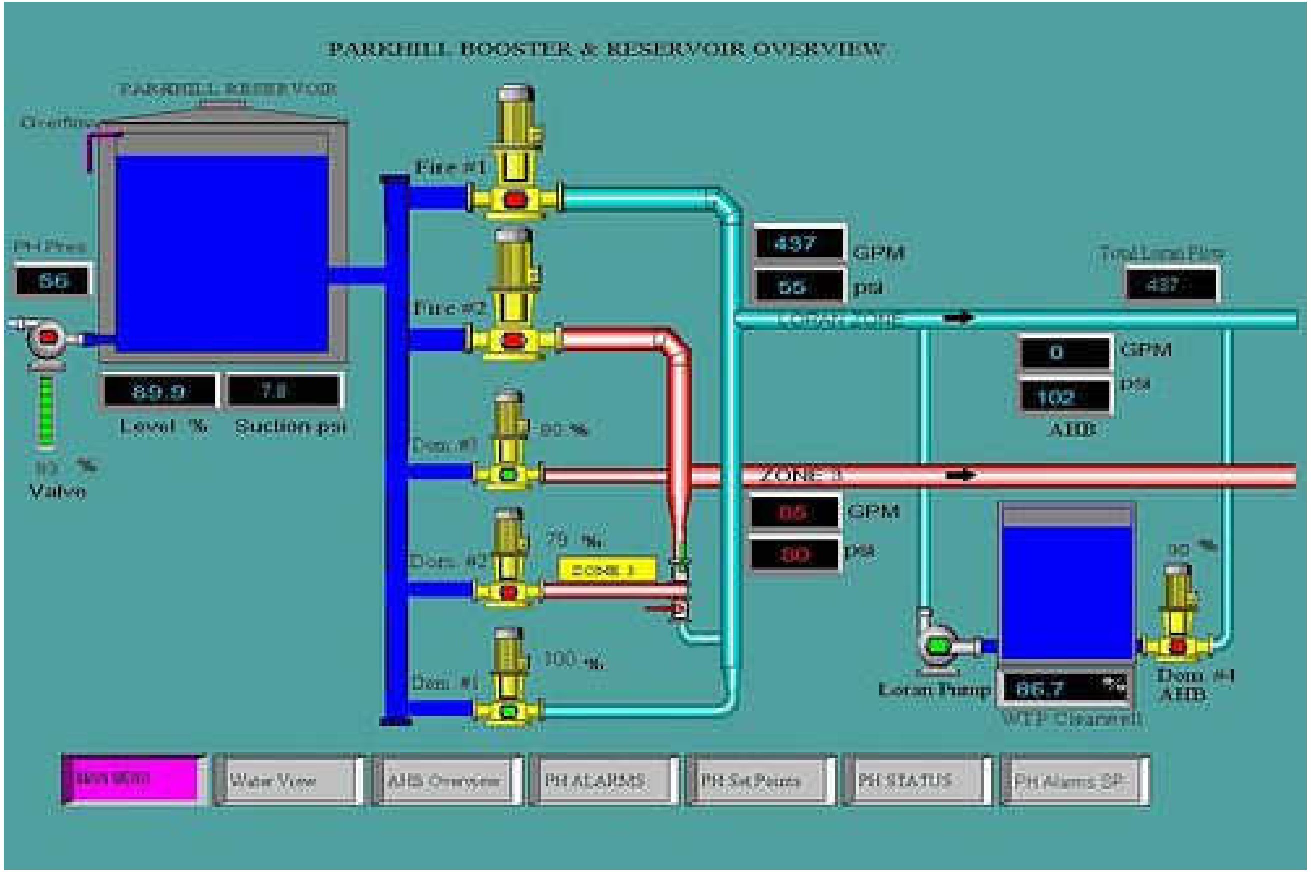

PARKHILL BOOSTER & RESERVOIR OVERVIEW
PARKHILL RESERVOIR
Overflow
PH Press
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89.9
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Suction psi
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90 %
Loran Pump
86.7 %
WTP Clearwell
Dom #4
AHB
MAIN MENU
Water View
AHB Overview
PH ALARMS
PH Set Points
PH STATUS
PH Alarms SP

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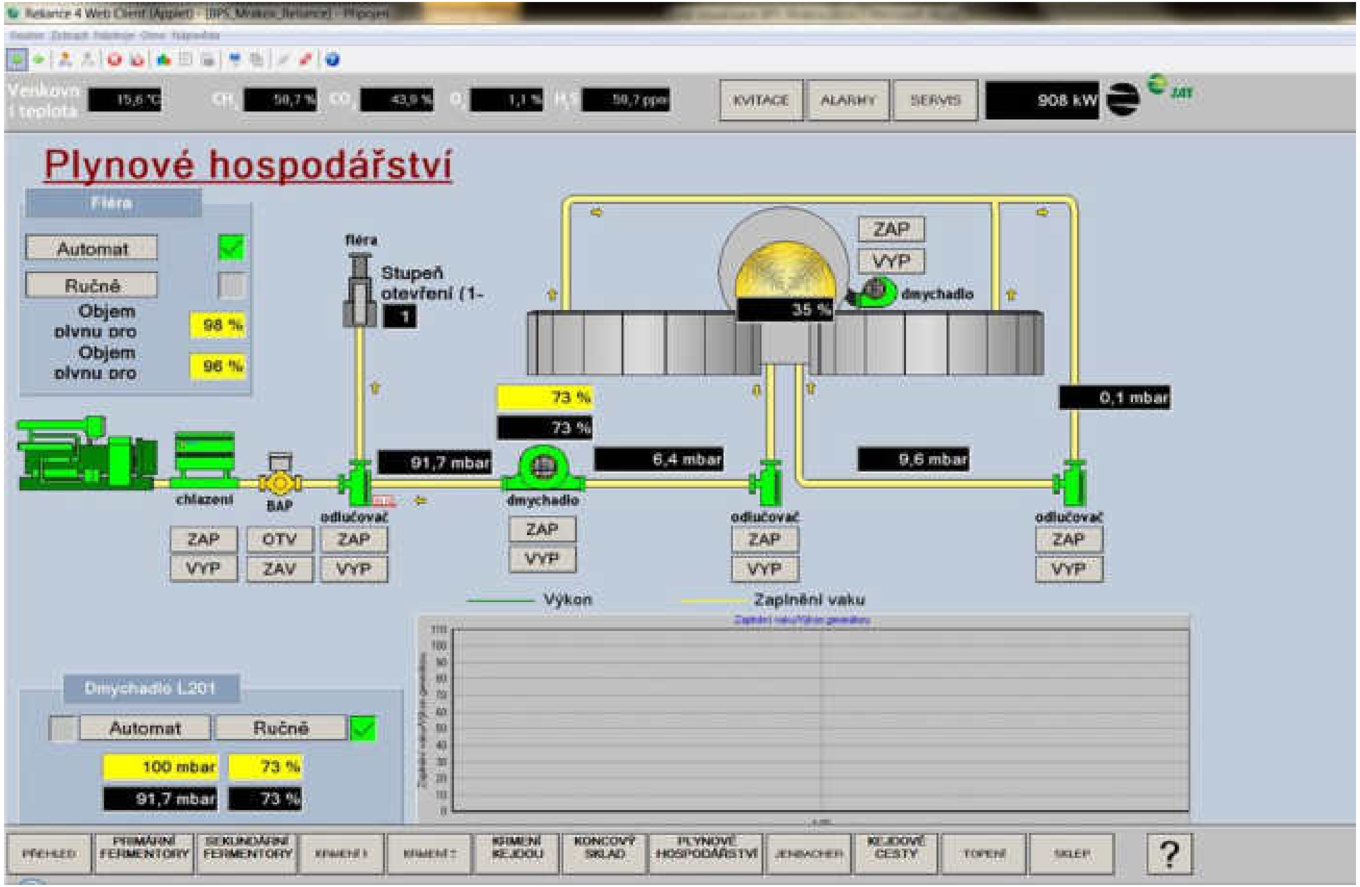


Plynové hospodářství

Venkovní teplota 15,6 °C

CH₄ 50,7 %

CO₂ 43,9 %

O₂ 1,1 %

H₂S 50,7 ppm

908 kW

Fléra

Automat ☑

Ručně □

Objem plynu pro 98 %

Objem plynu pro 96 %

Stupeň otevření (1- 1

Dmychadlo L201

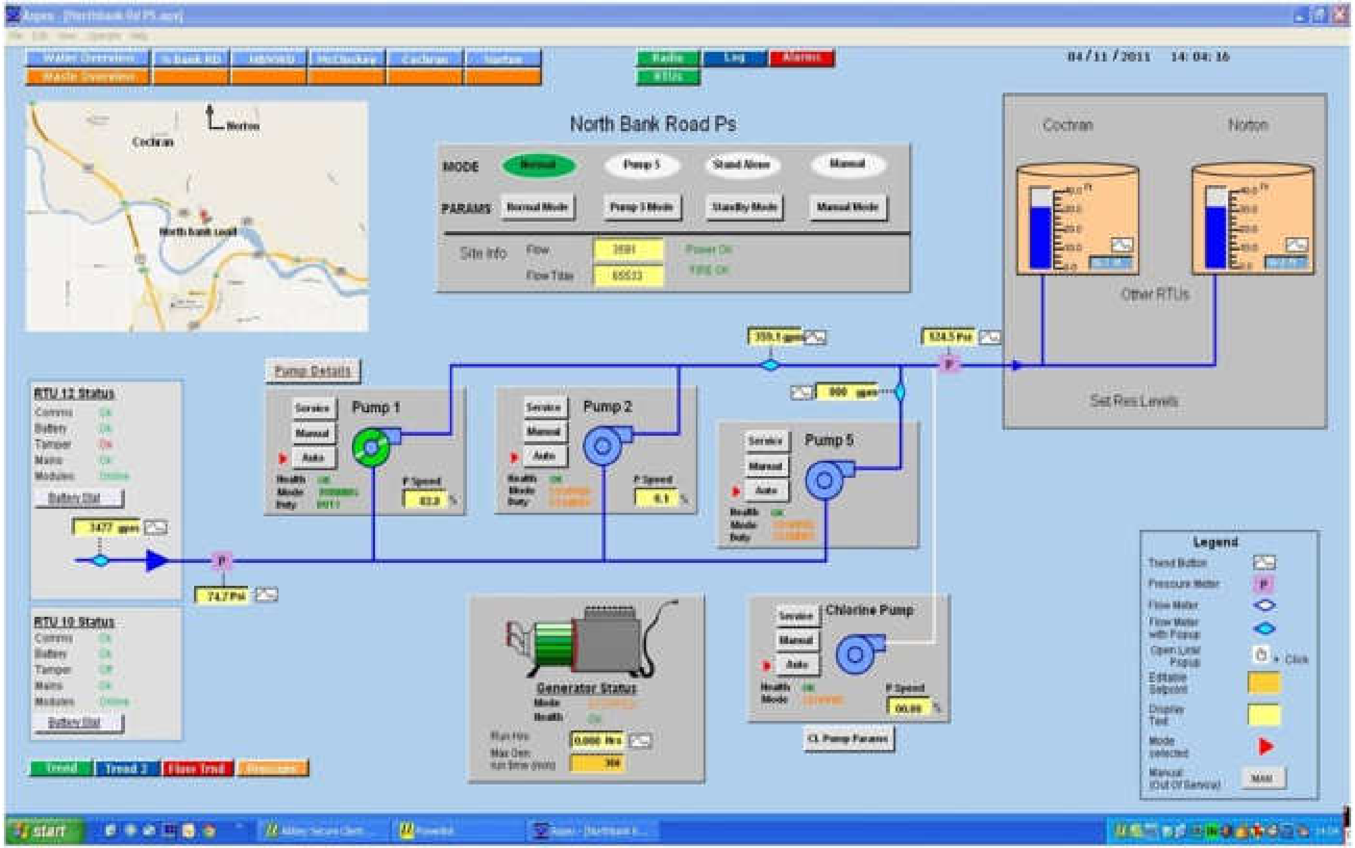
□ Automat

Ručně ☑

100 mbar 73 %

91,7 mbar 73 %

:(


Water Overview
Waste Overview
Radio
Log
Alarms
RTUs
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Cochran
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MODE
Normal
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Site Info
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Power On
Cochran
Norton
Other RTUs
Set Res Levels
Pump Details
RTU 12 Status
Comms
Battery
Tamper
Mains
Modules
Battery Stat
Service
Manual
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Pump 2
Pump 5
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83.3 %
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324.5 Psi
000 gpm
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74.7 Psi
RTU 10 Status
Comms
Battery
Tamper
Mains
Modules
Battery Stat
Generator Status
Mode
Health
Run Hrs
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Max Gen run time (min)
300
Chlorine Pump
Health
Mode
P Speed
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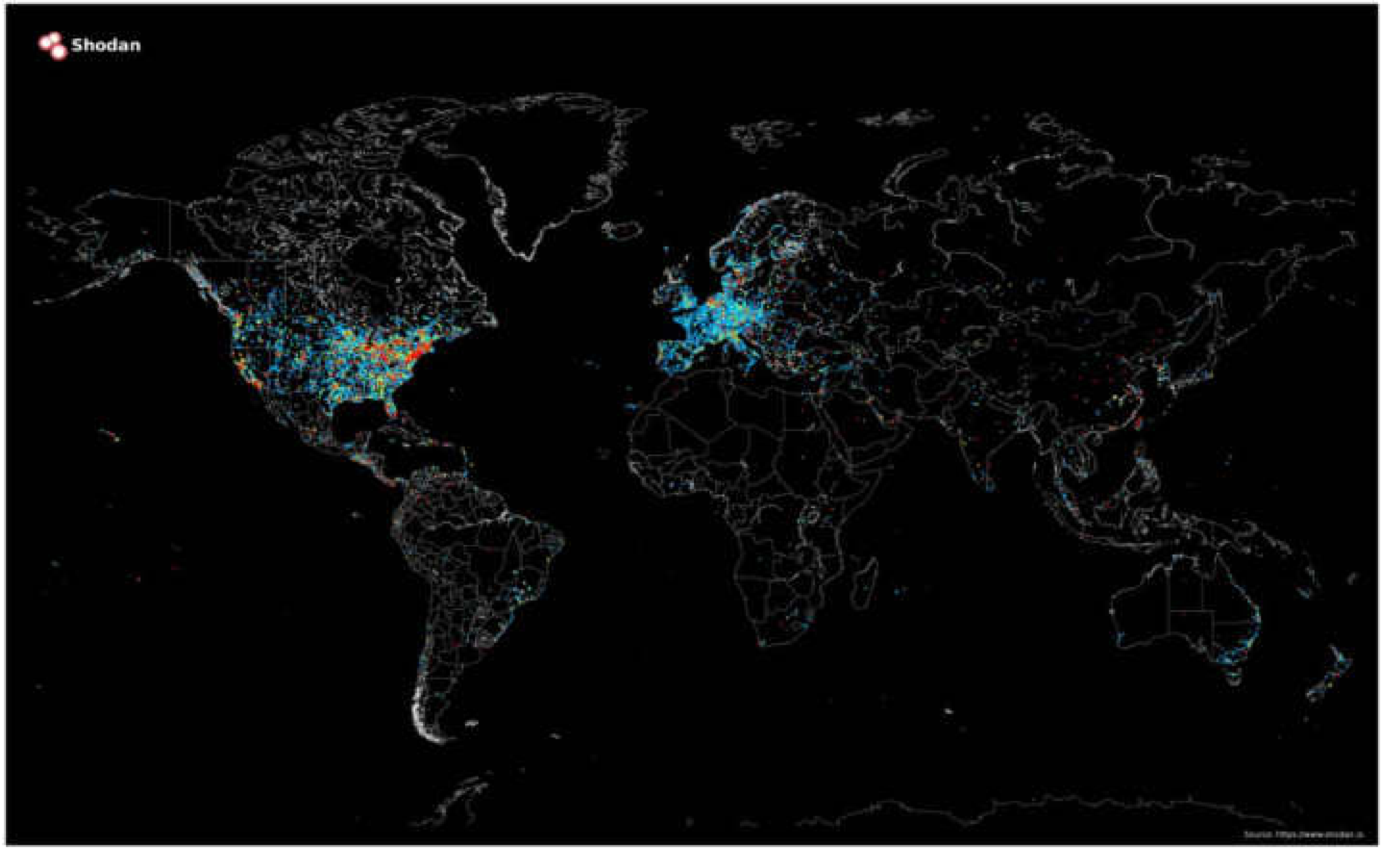
CL Pump Params
Trend
Trend 2
Flow Trnd
Legend
Trend Button
Pressure Meter
Flow Meter
Flow Meter with Popup
Open Link/ Popup
Click
Editable Setpoint
Display Text
Mode selected
Manual (Out Of Service)
MAN
start

How Many!?



Bad People Doing Bad Things

- Bad people wanting to do bad things don't even need a **password** for some critical systems
- Bored people looking to troll don't even need a password.
- So how easy is it for a targeted attacker who wants to cause some malicious trouble?
- This can't be good.

Infinite Monkeys, Typewriters, Etc

- Municipal control gear
- Smart meters
- Smart power grid controls
- All of this stuff sits outside a building somewhere
- Or on a customer's property
- Nearly infinite time to attack the devices because no-one is watching them

The Problem With Trust

- When you have no power and can’t be online all the time, how do you know who to trust?
- There’s a lot of wrong ways to do it, that’s for sure

Lets Make Fun Of Parking Meters

- Smart card parking meters are a good example of doing it wrong
- Parking meter has no idea what's going on
- All the trust is in the card.
- The card the user takes home and can poke at
- The card that the meter can't validate because it doesn' t have a live connection

Look At The Protocol

Meter: What is your region?
Card: “Oh, I’m region 1234.”
Meter: Great, what’s your ID?
Card: “ABCDE”
Meter: *Fantastic! Is “abracadabra” your password?*
Card: “Sure is, pal! And I’ve got $1000”
Meter: You should take away $0.50
Card: “I’ll get right on that, sure. No worries. Absolutely.”

Trusting The Untrustable

- This means *all* the trust is in the card
- The card is expected to compute the password
- This means the attacker *controls the entire mechanism of verification*
- Don’t even *have to know what the password algorithm is, just always say yes*
- There are/were *thousands* of meters using the *same* protocol across the US

Well, Lets Just Use Crypto

- OK. Sure.
- What crypto?
- How do you provision keys?
- Who controls your root of trust?
- How long is a key/cert valid for?
- How do you update a key later?
- If you're not online, how do you validate that trust?
- How do you revoke trust if something goes wrong?

Randomness

- Basically two ways to connect a device to a network
  1. Embed the key in the device at manufacture.
  2. Create a process where a new key is negotiated as a device joins the network
- Neither is without flaws
- Both require random data to build a session key
- Being random is hard

Embedded Keys

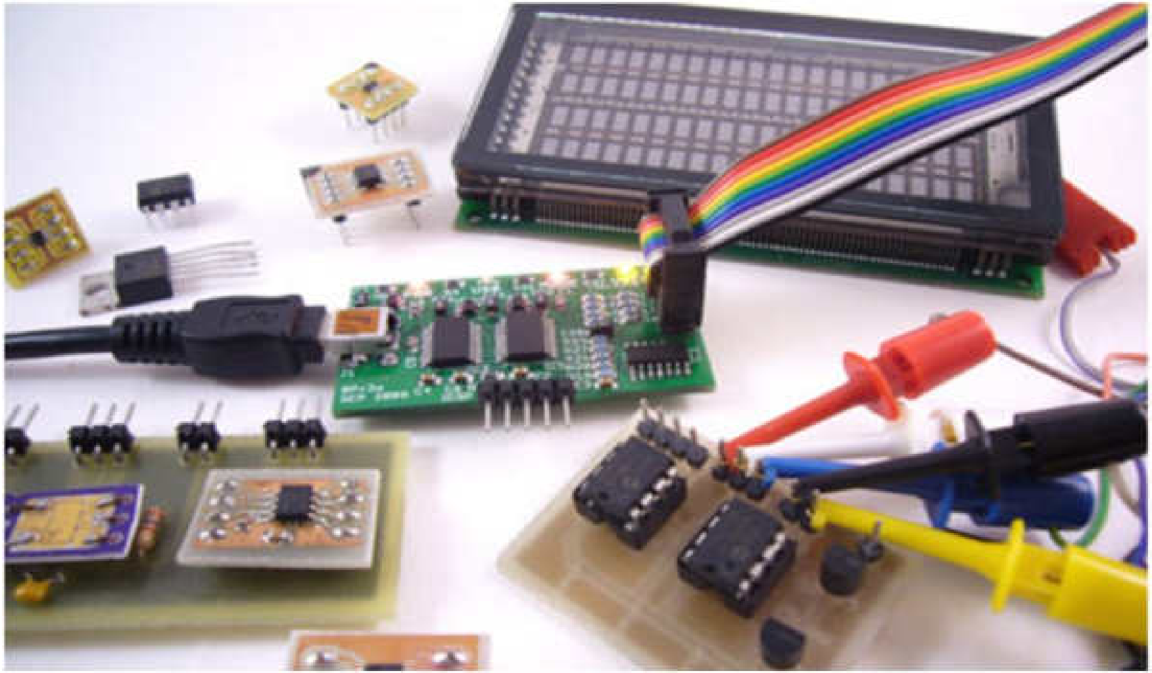
- Many ways to extract embedded keys
- Access any standard flash chips, SD cards, etc that may be in the device
- Disassemble firmware update
- Glitch CPU to image firmware and disassemble
- Snoop physical connection between CPU and Radio

Isn’t That Hard?

- Isn’t sniffing hardware… hard to do?
- Well, even if it was, would that really stop someone?
- But it isn’t.
- $30 in hardware, free software
- Documentation for nearly all microcontrollers readily available

Sniffing SPI data with Bus Pirate

Posted on Sunday, February 12th, 2012 in Bus Pirate, how-to, MSP430 by the machinegeek



Greg Whitmore at Four-Three-Oh forum has written a quick how-to post on using the Bus Pirate to sniff SPI data on the MSP430. We're reproducing the post here in its entirety with Greg's permission.

Dynamic & Session Keys

- Crypto relies on there being a source of randomness which is unguessable
- Often provided on a PC by user input, disk I/O, and RNG in the CPU
- Your lightbulb and toothbrush won’t have these, neither will industrial control gear or lightweight sensors
- Maybe sample some sort of sensor to generate randomness?

Silence

- So maybe we can sample the radio for power levels. That’s kind of random, right?
- What happens if you put it inside a faraday cage w/ no radio signals?
- Make your random seed 0?
- Predictable crypto keys
- Can expose comms, allow control of network, etc

All Of This Has Happened Before

- This isn't even far fetched
- In 2006 Debian made some changes to the OpenSSL code because it looked like it was using uninitialized memory
- This meant the entire source of randomness for nearly all crypto options was the process id
- ie 1-32767
- It was discovered in 2008. *Two years later.*

In The Meantime…

- Every SSL key generated by a Debian or Ubuntu system was guessable
- Every SSH server key
- Every SSH user key
- Session keys
- Usually in seconds
- It was so non-random it was possible to pre-compute every possible key the system would generate for SSH ahead of time

And The Beat Goes On

- Since session keys are guessable
- All data saved from those two years could be retroactively decrypted
- Good thing no-one was doing bulk data collection in the 2000s, right?
- All because of commenting out one line of code because it produced an error in a memory analysis tool

Can You Trust Your HW?

- But say you have a HW random number generator
- Can you even trust it?
- Where was the CPU made? Where is it used?
- If there’s money in attacking it, it’s being attacked
- Research shows it’s possible to remove nearly all entropy from a hardware RNG by manipulating the CPU manufacturing mask
- Long after validation, when no-one can see it
- Uh oh.

I Have The Power

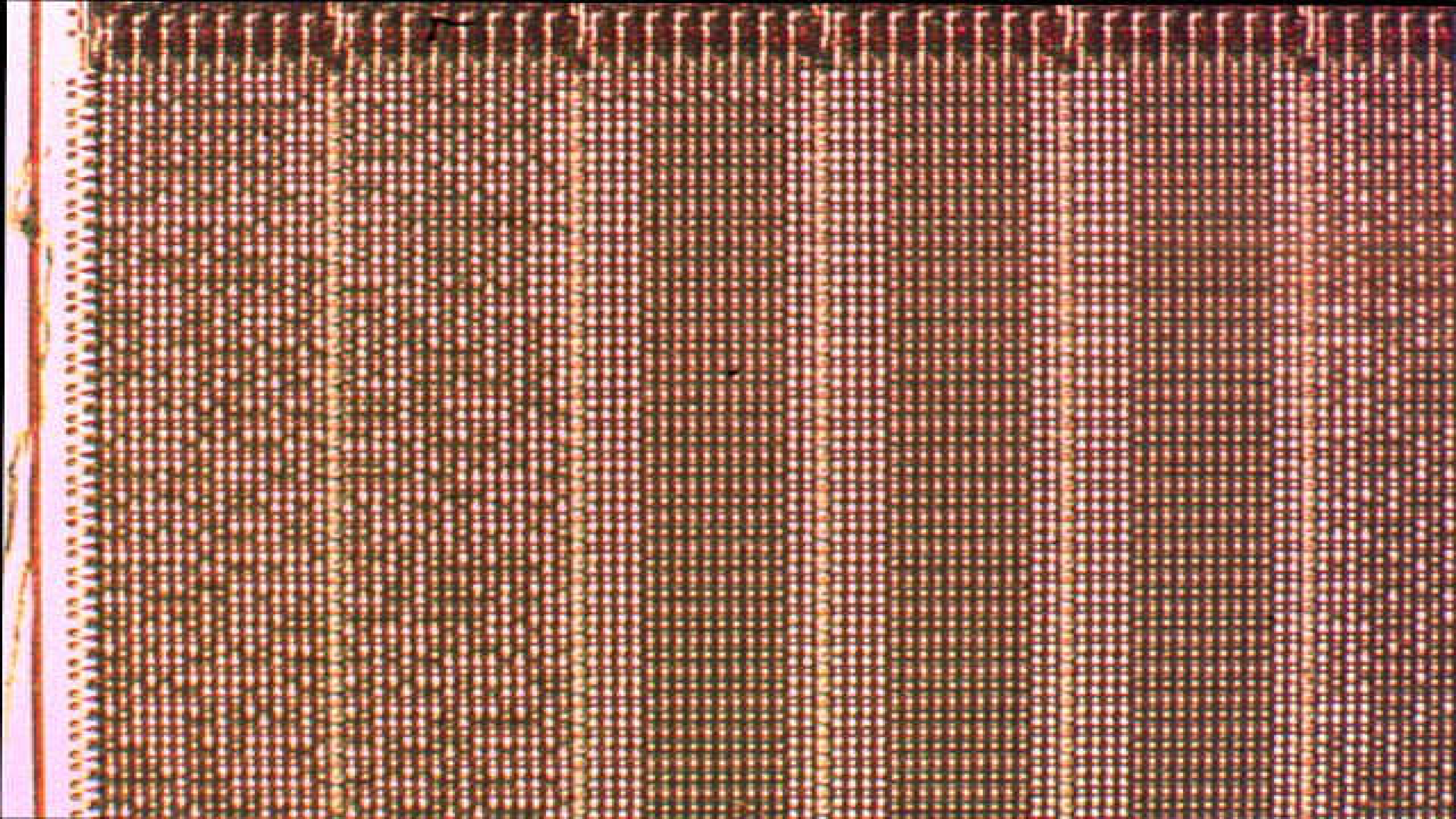
- When you control the physical system all sorts of other things become available
- Closely monitor the CPU power consumption & use that to derive the encryption keys
- Or, just image the firmware off the chip by controlling the power

Yes? No.

- CPU boots
- Ask CPU for firmware access
- CPU says no
- This is controlled by setting a register
- What happens if you under-volt the CPU, at just the right time, so much that it can't, electrically, lock the register?
- "Can I read the firmware?" "Yes".

Masked Avenger

- What if there is no flashable firmware, and it's just in ROM?
- That can be even easier
- Decap the chip with nitric acid
- Photograph it under a microscope
- *Literally read the code from the transistors*
- People do this.
- For fun.



Not Just Fairy Tales

- Not just a tin foil hat fairy tale
- DECT cordless phone encryption cracked by imaging the ROM chips from a phone
- Extracted hard-coded encryption keys & the code for the encryption algorithm

Just A Matter Of Time

- If someone can control the entire environment of a device, cracking it is just a matter of determination and time
- Resources help
- Is it worth cracking a lightbulb? It is if you're making a competing product or cloning it
- Is it worth cracking a power meter network? That's a good question

Where Does All This Go, Anyhow?

- Wait… almost none of these things install a server in your house…
- So where does all your configuration data end up, anyhow?
- (And your power usage, times you’re home, info about your TV shows, how often you brush your teeth, where in the yard your dog is…)
- I guess it goes in the cloud?

It’s Just Computers

- Everyone loves The Cloud!
- The cloud is magical! It’s where Netflix lives! It’s got infinite capacity and processing!
- But really, it’s just computers
- Other peoples computers
- Somewhere else
- So...

Cloud + Security

- Anything you do in the cloud is only as trustworthy as the people owning the computers
- And their company
- And their government

- And their security.

Software Security

- Hypervisors are great
- And as we’ve learned, security is *real easy* right?
- Of course there are bugs in the virtualization space
- Bugs in VMs can be really bad since they hit more than one server

I See What You're Doing There

- Lets accept for the sake of argument that the hypervisor is good enough that client "A" can't look at what client "B" is doing
- The hypervisor still can
- So… your crypto keys, your SSL private keys, your customer data, your database passwords, anything you compute/operate on in memory
- This doesn't even need a bug, just a bad operator
- Boy that's a *lot* of trust for $15/mo…

Physical Attacks - Again!

- Latest “fun” is the Row Hammer attack
- Attacks the physical architecture of DDR4 RAM allowing processes to gain admin/root
- From a *physical flaw in how RAM functions.*

…

- … ***FROM JAVASCRIPT***

Ram Is Tiny

- RAM is rows and columns addressed as a matrix
- Memory is really tiny and packed really close
- By flipping the contents of RAM rapidly it's possible to cause errors to occur in **adjacent** rows due to electrical fluctuations
- Possible to tune these errors to cause RAM to change in areas completely outside of your programs normal control
- Actually proven to work. It's amazing.

ECC? We Don’t Need No ECC

- But servers use error-correcting RAM, don’t they?
- Yep, but it doesn’t solve the problem
- Attacks proven against ECC, too

Even Worse On Virtual Machines

- It gets even worse on virtual machines!
- To save memory, hypervisors perform page de-duplication
- If two (or more) pages of RAM are identical, they're compressed into a single page and referenced from multiple locations
- Things like glibc, kernel memory, etc end up in de-duped pages

One Page To Rule Them All

- Normally de-duped pages are read-only
- By finding de-duped pages via timing and page faults, specifically target pages of memory which are shared
- Modify a non-writeable page by corrupting it via attacks on adjacent rows
- Modify all VMs sharing that page
- … Uh oh.

Can You Solve A Physical Bug?

- Some attempts remove the instructions in the JS VM that perform the rowhammer
- Try to profile memory access and stop programs that are exploiting it
- BIOS updates that change how memory refreshes are performed
- Hope there isn't a new variant that bypasses these stopgap fixes once millions of machines are (maybe) updated

We’ll Just Use Open Source

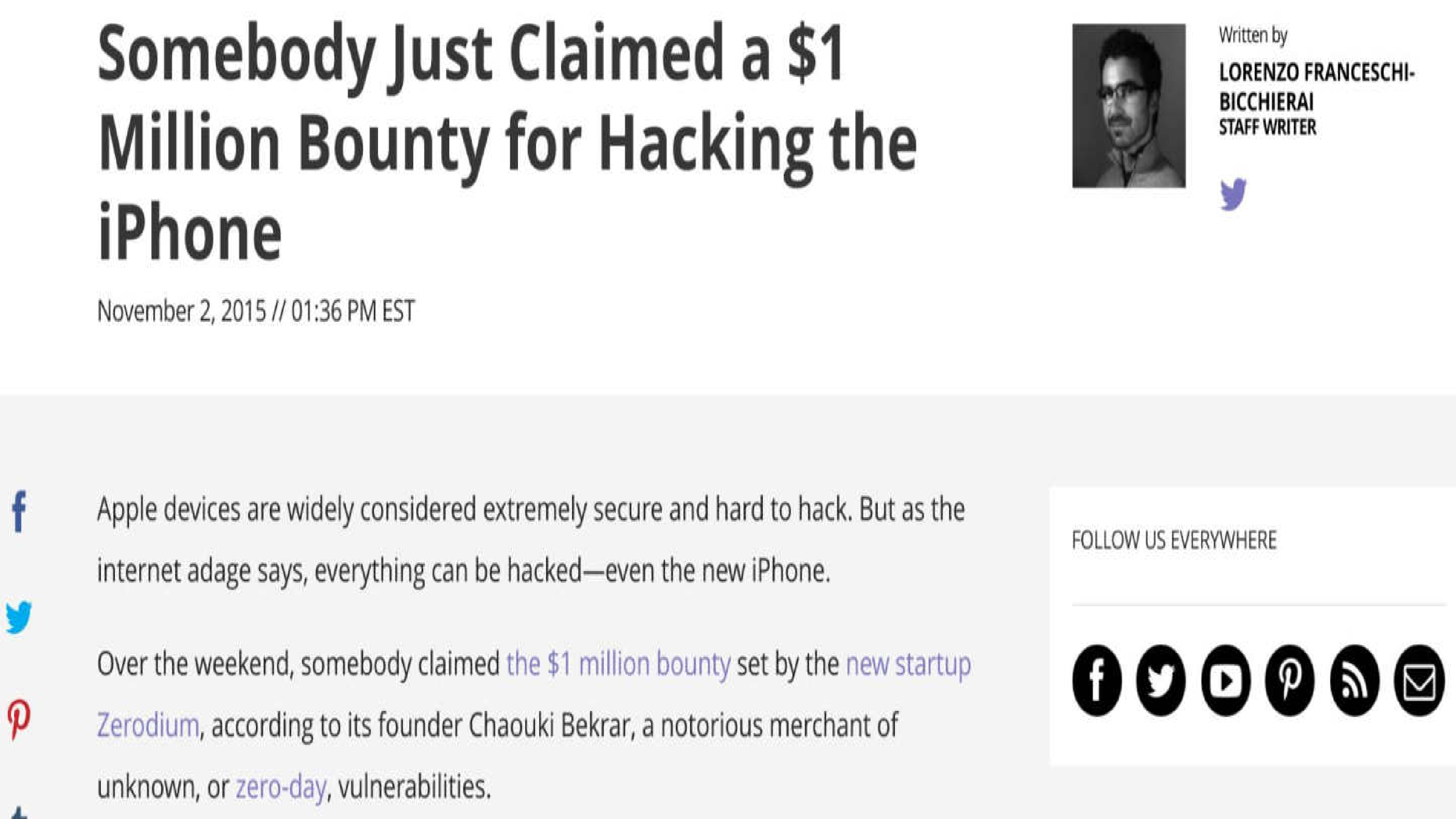
- But most virtual hosting systems run Linux
- And Linux is open source
- And open source prevents security bugs, right?

Even Open Source Has Bugs

- The lesson here: ***Everything has bugs***
- What matters is ***being able to respond to them***
- Open source ***may*** be better at responding to them
- ...
- But not always
- There’s many layers between an update and end users
- Servers can still be out of date
- Bugs may go unreported or (publicly) undiscovered

Bugs Have Value

- Part of the problem is vulns have value now
- There are marketplaces for vulns
- Buyers can be criminals, or governments, or both
- Vulnerabilities can be worth thousands or even millions of dollars
- That's a lot of incentive to keep and sell it privately



Somebody Just Claimed a $1 Million Bounty for Hacking the iPhone

Written by

LORENZO FRANCESCHI-BICCHIERAI
STAFF WRITER

November 2, 2015 // 01:36 PM EST

Apple devices are widely considered extremely secure and hard to hack. But as the internet adage says, everything can be hacked—even the new iPhone.

Over the weekend, somebody claimed the $1 million bounty set by the new startup Zerodium, according to its founder Chaouki Bekrar, a notorious merchant of unknown, or zero-day, vulnerabilities.

FOLLOW US EVERYWHERE

Why Are They Worth Money?

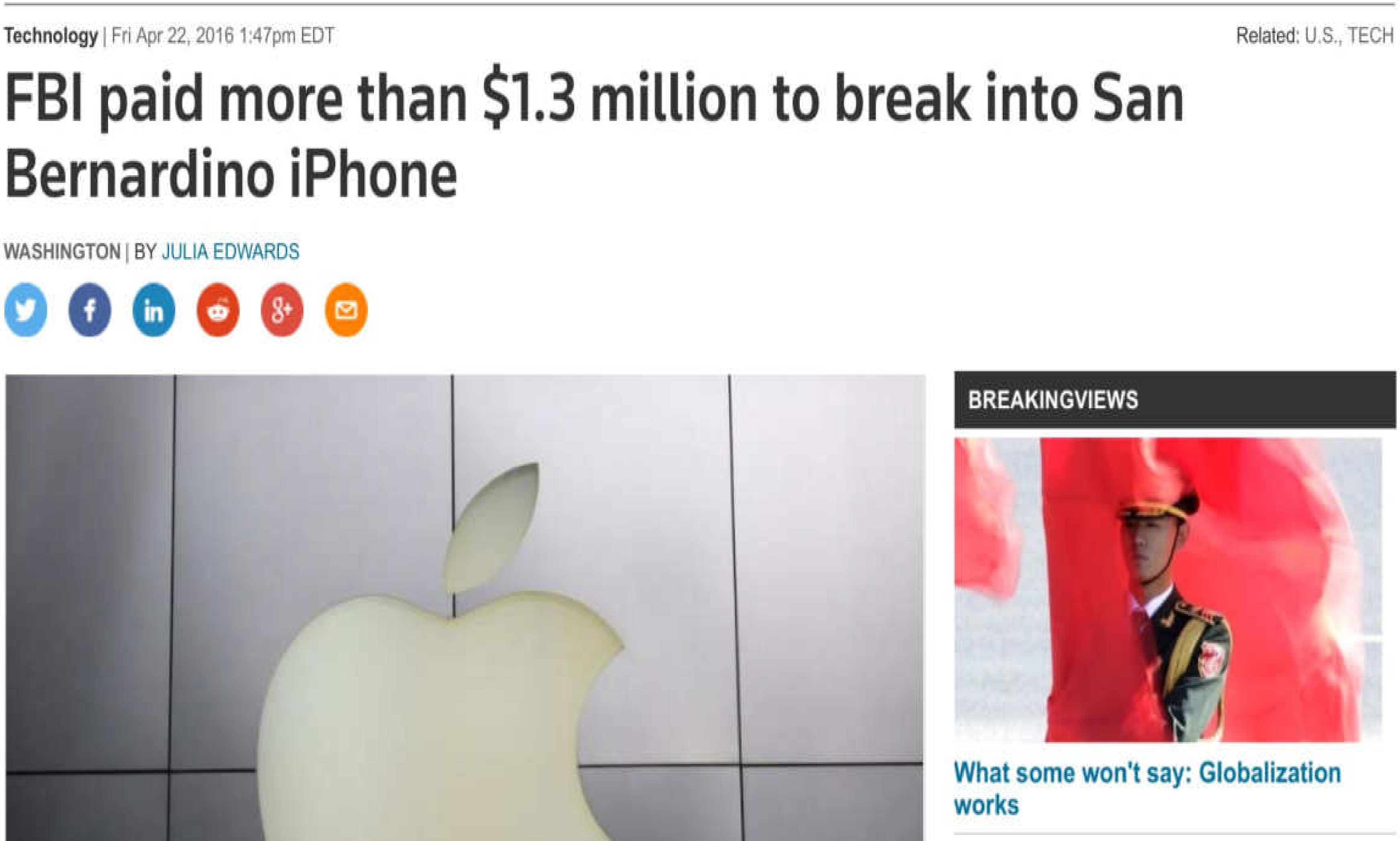
- Valuable to criminals for installing malware
- Valuable to governments for the same reason (or if you want to be charitable, for accessing devices legally)
- Valuable to security companies who use them during break-in tests or when reselling their services to companies or governments

It’s A Big Market

- It’s a big market
- Bigger than most people realize
- Escape from Chrome sandbox? $300k - $500k
- Still use Flash? $200k-$500k
- Windows remote exploit? $500k-$1m
- There’s real money out there changing hands for exploits that likely impact everything you do on the Internet

Why So Valuable?

- So you should be asking: Why are these so valuable
- What are the buyers doing with them?
- iOS jailbreak sold for $1m to Chinese firm
- Jailbreak software installed an alternate marketplace for Apps on every phone it was used on
- Presumably there was at least a million in revenue captured by selling apps outside of Apple



Technology | Fri Apr 22, 2016 1:47pm EDT

Related: U.S., TECH

FBI paid more than $1.3 million to break into San Bernardino iPhone

WASHINGTON | BY JULIA EDWARDS

BREAKINGVIEWS

What some won't say: Globalization works

Blurring The Line

- The line between “project” and “product” is rapidly blurring
- OpenSSL is a project until recently maintained by one or two people
- But used in millions of *products* worldwide

Isn’t This Regulated, Somehow?

- Yes and no
- Legal regulations move slow
- And paint with a broad brush
- And are often fairly toothless

What's An Exploit?

- Even if you think it should be regulated
- What's an exploit?
- What's research?
- Do laws stop criminals from doing something illegal, anyhow?
- Better to support finding flaws and fix them than not know the risks

Research, Research, Research

- There’s too much money for people to ignore vulnerabilities
- They’re going to be found
- And sold
- And used
- The ones you hear about which make it into patches are the success stories
- Someone, somewhere, just lost a lot of money when that got fixed

Have We Learned *Anything*?

- Have we managed to learn ANYTHING?
- Well, sort of...

Good: We're A Little Less Afraid Of Bugs

- We've gotten a bit better about understanding that bugs happen
- Hackers aren't *always* demonized for reporting bugs
- Many major companies have bug bounty programs and public vulnerability reporting

Bad: We suck at updating

- We’re still terrible at updates
- We’re networking devices for no reason
- There’s a lot of contention between security and government
- The 1980s crypto wars are upon us again

Bad: Stunt Hacking

- There seems to be a culture of “stunt hacking”
- High-profile bugs demonstrated in high-profile ways
- Don’t demonstrate hacking cars on a public highway
- Not every bug needs a cute name and logo
- You don’t need to hire a PR company for your bugs

Stunts Hurt Everyone

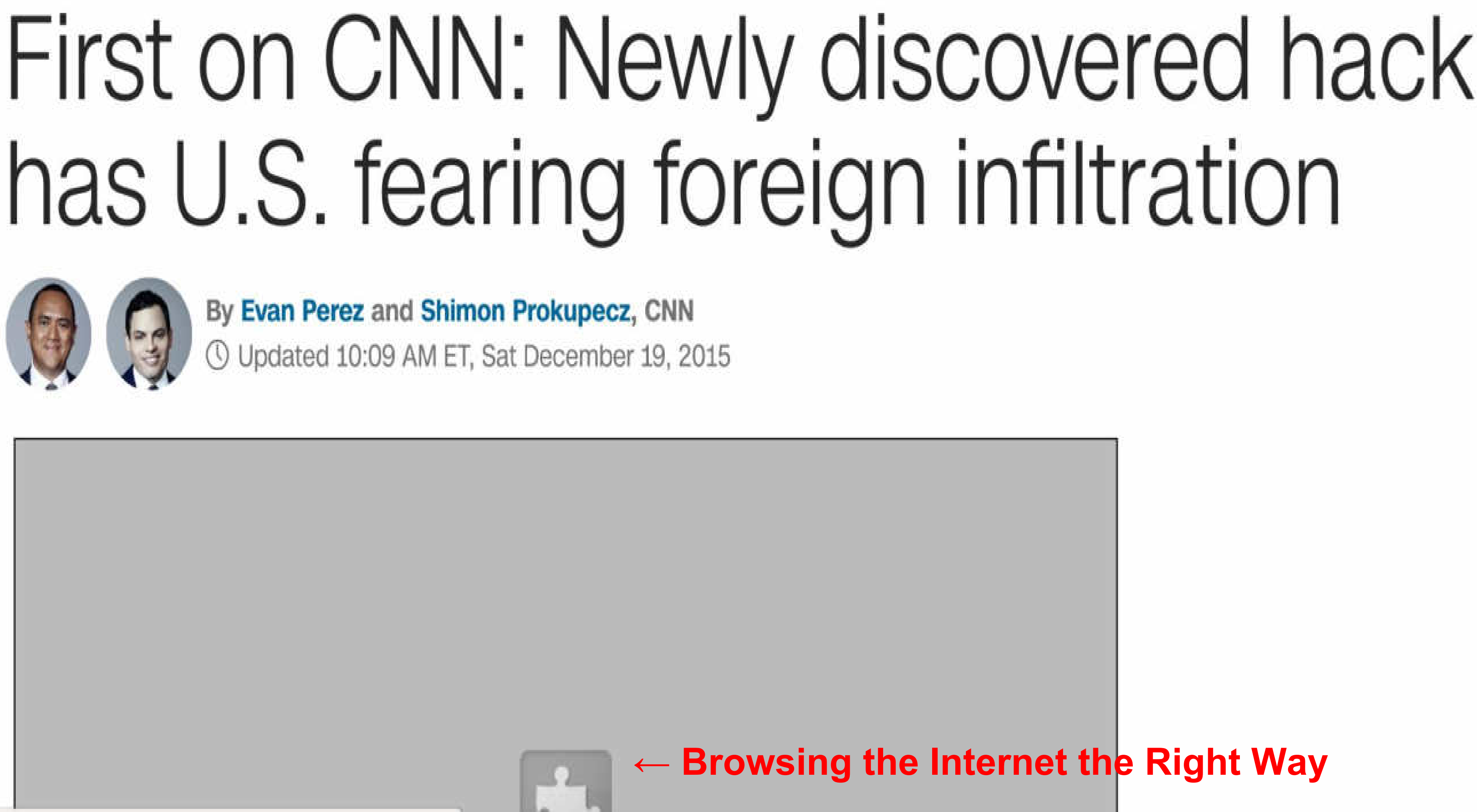
- Stunt hacking isn’t just obnoxious
- Everyone wants to make headlines
- Unfortunately headlines convince people that something Must Be Done
- And that Something may not be well considered

Legal Quagmire

- Govt wants access to data and devices
- People generally don’t want the government to access their data
- Government may or may not be accessing devices legally
- What defines legally?
- Whose government?

Doors Don’t Care

- Doors don’t care who opens them
- Put a hole in the system and anyone who finds it can use it
- This weakens it for everyone
- Many governments want back doors into all crypto systems
- But governments are so good at keeping secrets!
- And never get hacked, right?



First on CNN: Newly discovered hack has U.S. fearing foreign infiltration

By Evan Perez and Shimon Prokupecz, CNN

Updated 10:09 AM ET, Sat December 19, 2015

← Browsing the Internet the Right Way

U.S.

Hacking of Government Computers Exposed 21.5 Million People

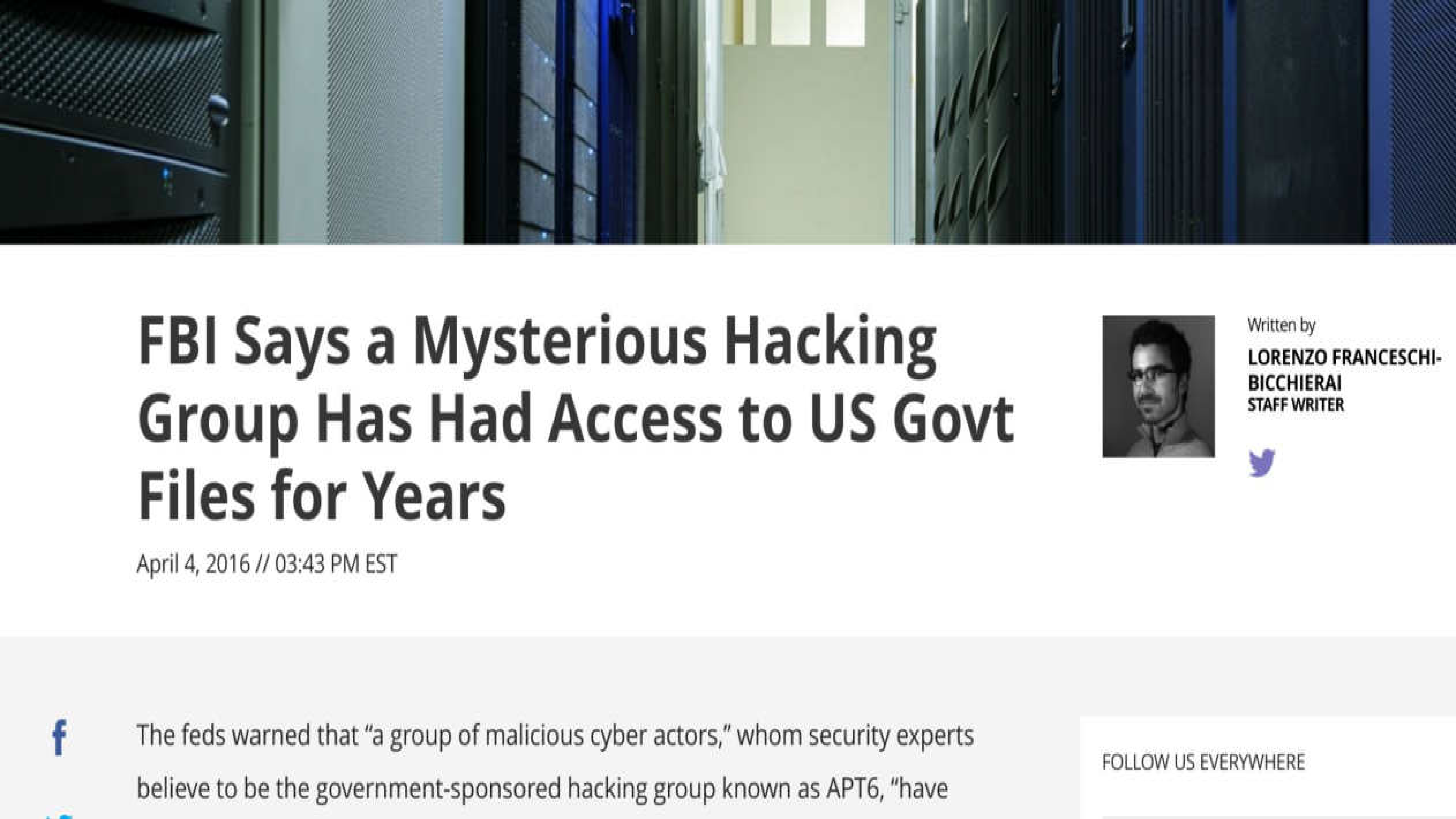
By JULIE HIRSCHFELD DAVIS JULY 9, 2015

Why the IRS Was Hacked Again and What the Feds Can Do About It

How can U.S. government agencies be better prepared to protect their sensitive data?

By The Conversation | Contributor   Feb. 16, 2016, at 11:46 a.m.

MORE

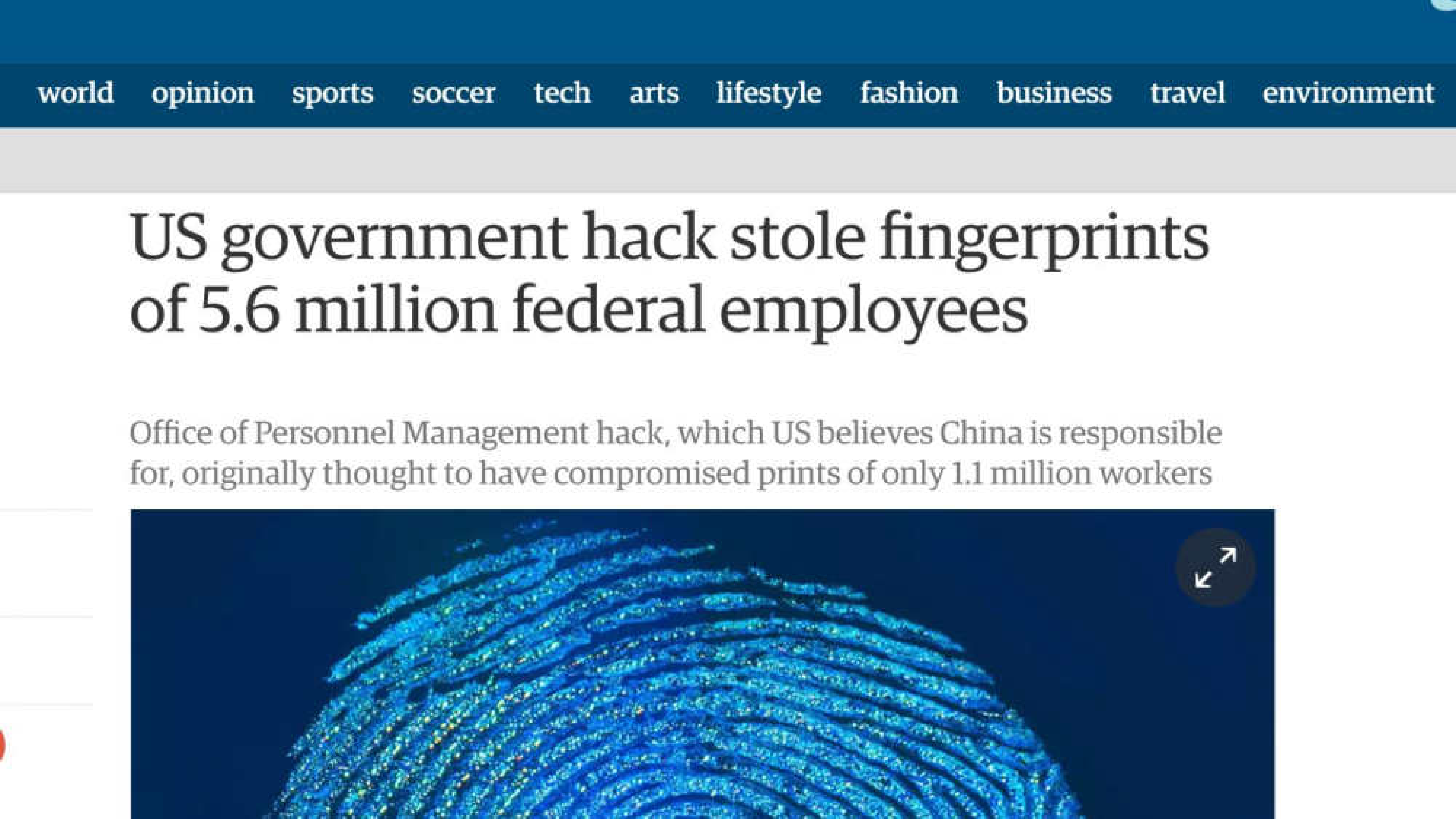


FBI Says a Mysterious Hacking Group Has Had Access to US Govt Files for Years

April 4, 2016 // 03:43 PM EST

Written by
LORENZO FRANCESCHI-BICCHIERAI
STAFF WRITER

The feds warned that "a group of malicious cyber actors," whom security experts believe to be the government-sponsored hacking group known as APT6, "have



US government hack stole fingerprints of 5.6 million federal employees

Office of Personnel Management hack, which US believes China is responsible for, originally thought to have compromised prints of only 1.1 million workers

No, It’s Good

- Clearly, these are the right people to decide to backdoor what security we have.
- It’s good.
- We’ve got this covered.

So…

- Security is hard
- We don’t really know how to do it
- No-one can stop products from being insecure
- Back-room dealing will always put preferred devices into play regardless of security
- We’re actively trying to make it worse
- We’re going to be stuck with bad security indefinitely
- Get off my lawn with your lightbulbs and your car updates and your… zzz…