

RSA® Conference 2019

San Francisco | March 4–8 | Moscone Center



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SESSION ID: SEM-M01

Security and Privacy Challenges for IoT

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Four New IoT Challenges for Privacy and Security

1. Intimacy of Devices and Data

- Fun Facts about Millennials
 - 83% sleep with their phones
 - 90% check first thing in morning
 - 1 in 3 use in bathroom



Four New IoT Challenges for Privacy and Security

1. Intimacy of Devices and Data

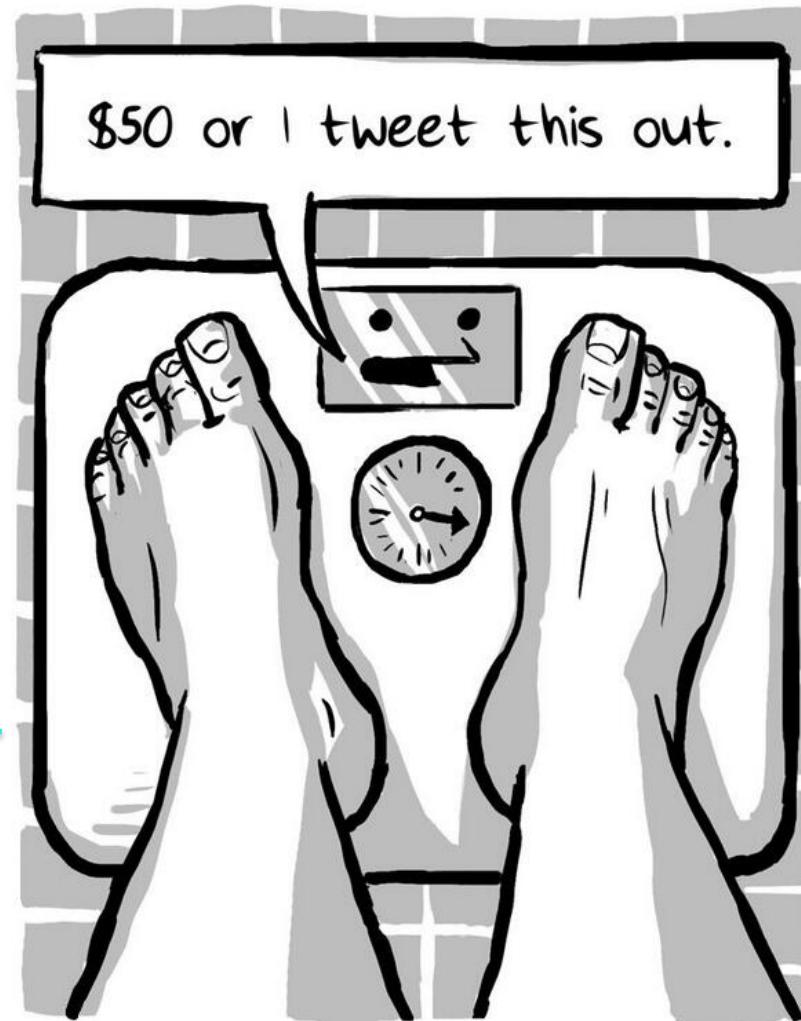
- Fun Facts about Millennials
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- Our smartphones already know:
 - Who we know, where we go, what we like



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- Our smartphones already know:
 - Who we know, where we go, what we like
- Will only become more intimate with IoT
 - This also means new kinds of intrusive ads, data breaches, accidental data sharing



Four New IoT Challenges for Privacy and Security

2. Physical Safety

- Today, main problem is data breaches
- Tomorrow, huge potential for many nasty scenarios
 - Many new kinds of ransomware we haven't imagined yet
 - Malware that locks people out of their houses
 - Malware that turns off thermostats in winter --> burst pipes
 - Holding people and society virtually hostage
 - Autonomous drones or vehicles deliberately crashing into things
 - Implanted medical devices giving or receiving fake data

Four New IoT Challenges for Privacy and Security

3. Awareness of Devices

- In my first year teaching at Carnegie Mellon, met with students in their lab
- Didn't know until end of semester we were being broadcast on Internet the entire time!
 - Do you see the camera?



Four New IoT Challenges for Privacy and Security

3. Awareness of Devices



The Washington Post
Democracy Dies in Darkness

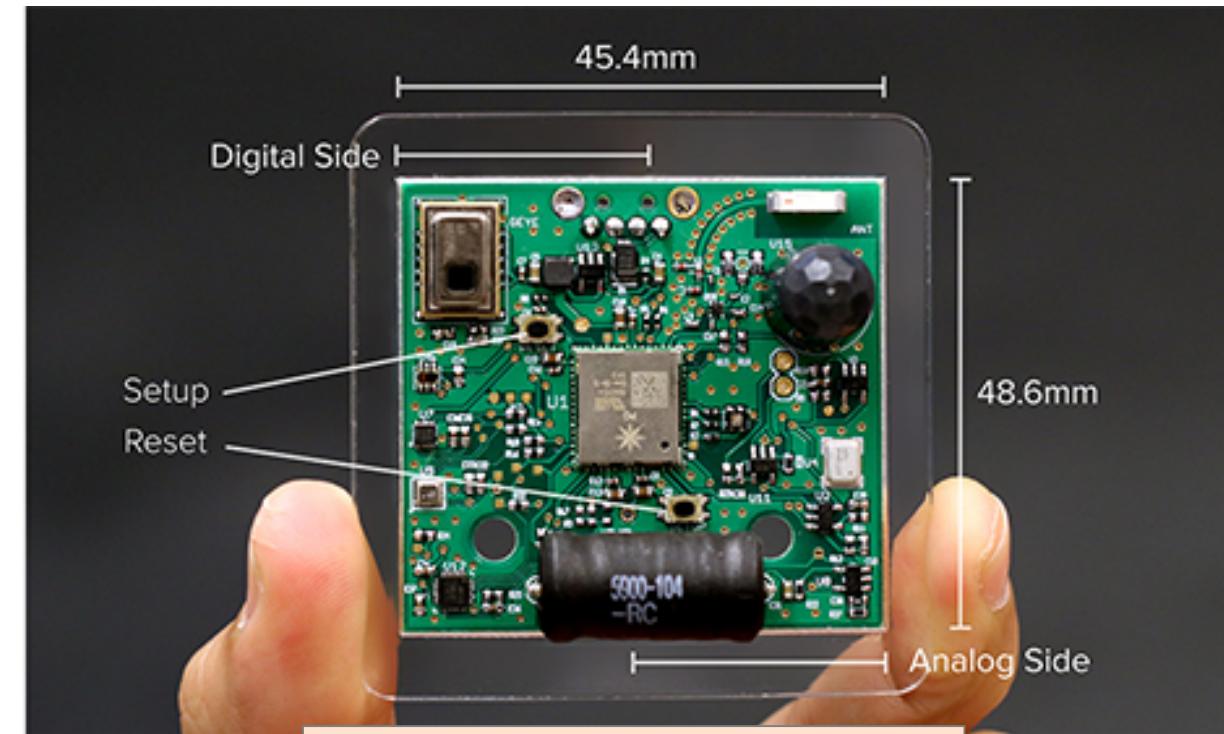
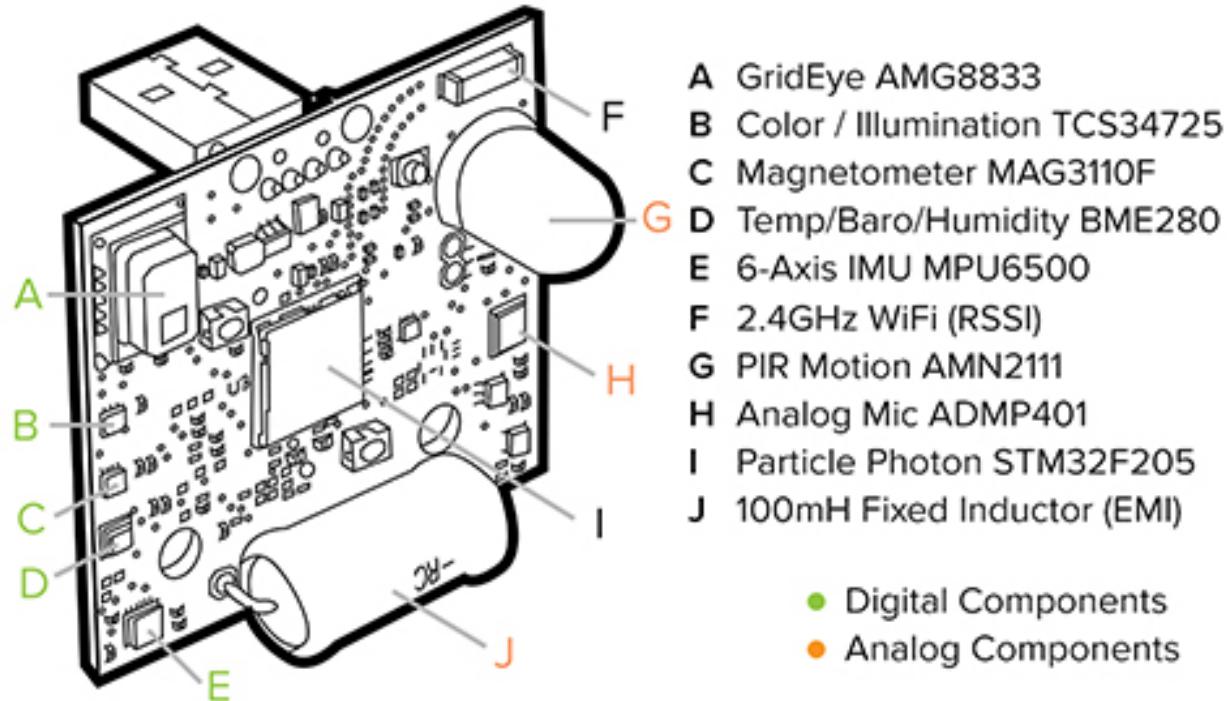
The Switch

Airbnb refunds guest who found indoor cameras during his family's stay

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3. Awareness of Devices

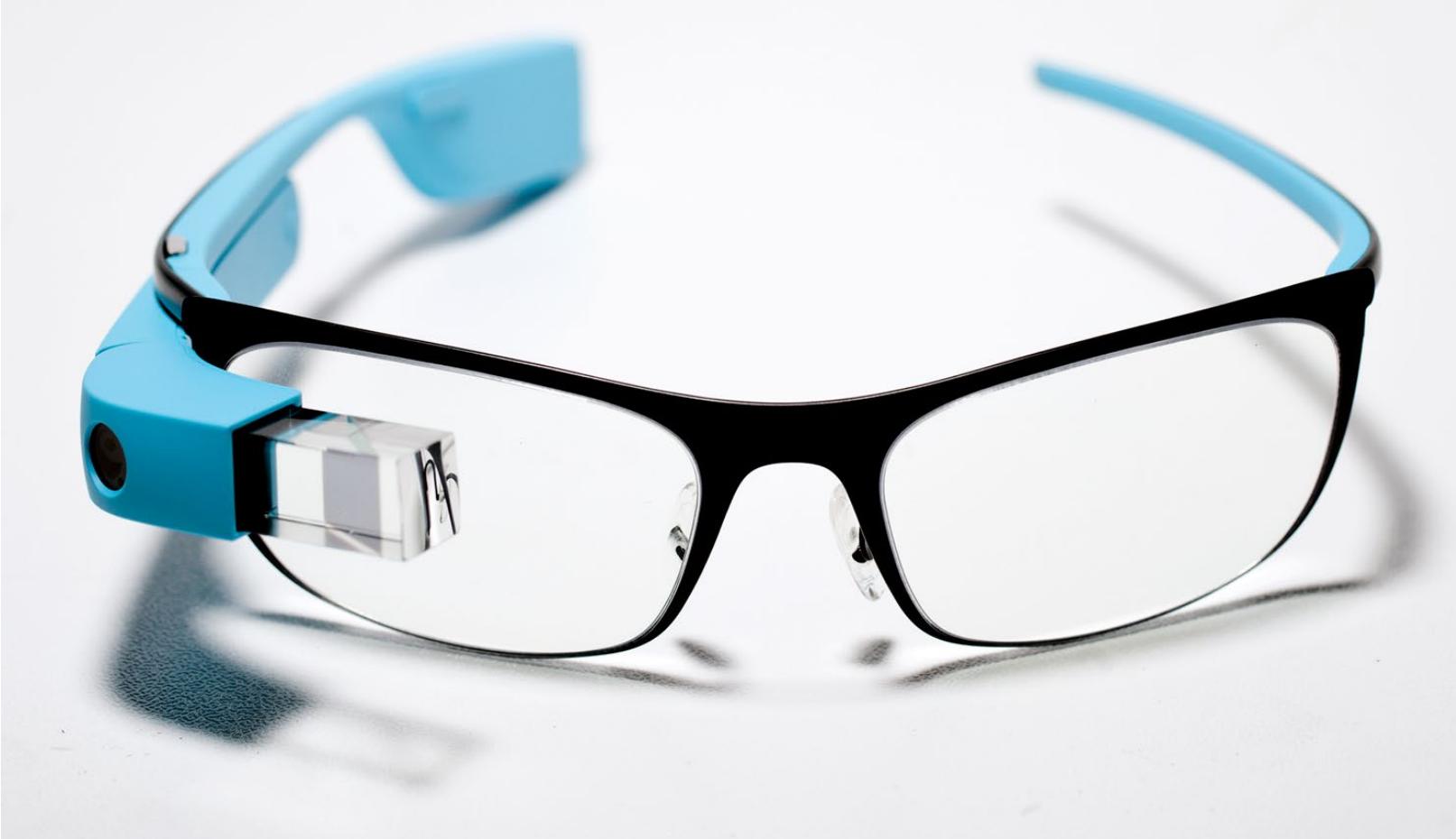
- More and more devices will be hard to notice
- Ex. Mites “supersensor” under development at Carnegie Mellon



Four New IoT Challenges for Privacy and Security

4. Complexity and Scale

- Lots of unexpected and emergent behaviors



How to Address These Privacy and Security Issues?

- Better technical approaches
 - Operating systems, networking, programming languages
- Better UX design
 - Better disclosures, awareness of devices, controls, decision making
- Better developer support
 - Most developers are C students
 - Tools, education, best practices for privacy and security
- Better laws, policies, and standards
 - Mandatory cybersecurity insurance for manufacturers
 - Tools to help policy makers, journalists, product reviewers

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How to Address These Privacy and Security Issues?

Operating Systems

- Our team is developing an open source IoT Hub
 - Think of it as a smarter WiFi router that protects IoT devices
- How far can we go if devices have simple metadata?
 - Ex. Here is my URL for software updates
 - Ex. Here is my Manufacturer Usage Description (MUDs)
 - Whitelist: this lightbulb communicates only with lights.intel.com
- What basic services can IoT Hub offer for all devices?
 - Ex. Disallow remote login for devices if well-known default password
 - Ex. Centralize telemetry and learn patterns

How to Address These Privacy and Security Issues?

Awareness of Devices

- Our team looking at physical dimension of IoT privacy
 - Ex. Make it easy to see where camera is and where it's pointed
 - Want something cheap (so manufacturers will adopt) and effective
 - Testing out LEDs, audio, virtual maps



How to Address These Privacy and Security Issues?

Awareness of Devices



LEDs off



If device has camera -> LED on

Summary

- IoT poses many new challenges to privacy and security
 - Ex. Intimacy, physical security, awareness, complexity
- Existing approaches for privacy and security insufficient
 - Will require innovations in tech, UX, education, legal, standards
- We're not going to have many second chances for IoT, and business as usual will be disastrous
- Let's make sure we create a world we would want to live in
- Contact me at jasonh@cs.cmu.edu

